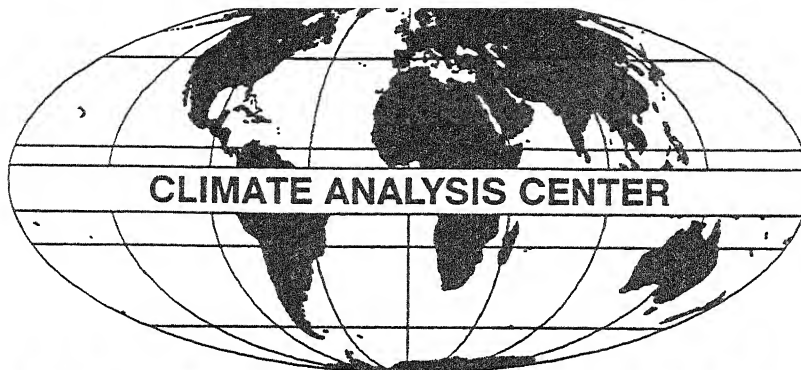


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CONTAINS:
AUTUMN 1991
UNITED
STATES
CLIMATE
SUMMARY

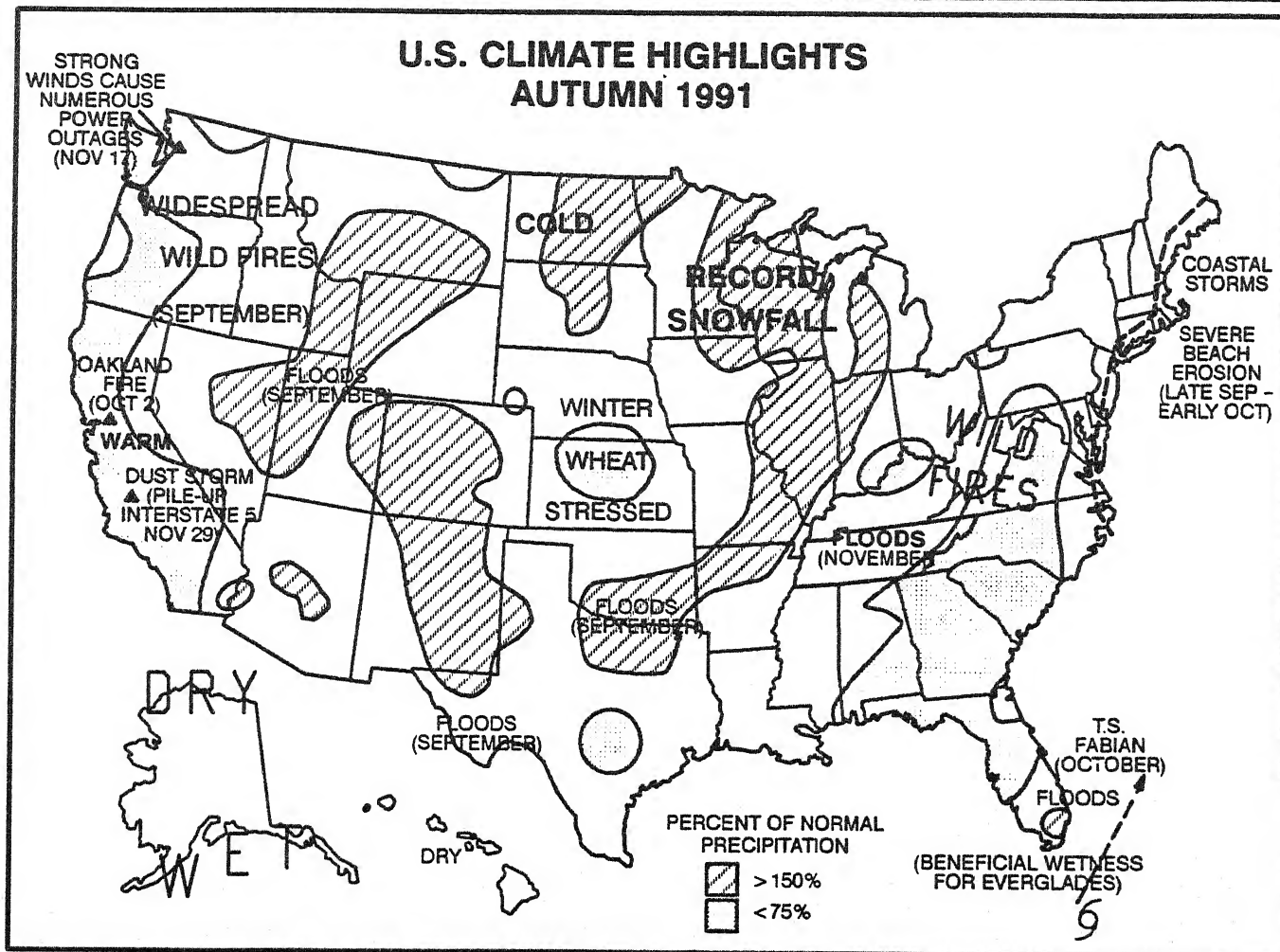
WEEKLY CLIMATE BULLETIN

No. 91/50

Washington, DC

December 14, 1991

U.S. CLIMATE HIGHLIGHTS AUTUMN 1991



Autumn 1991 produced a wide variety of dramatic weather conditions that resulted in floods, destructive storms, wildfires, copious snows, and hundreds of new daily maximum and minimum temperature records. For further details, refer to pages 9 - 16.



UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE-NATIONAL METEOROLOGICAL CENTER
CLIMATE ANALYSIS CENTER



WEEKLY CLIMATE BULLETIN

This Bulletin is issued weekly by the Climate Analysis Center and is designed to indicate, in a brief concise format, current surface climatic conditions in the United States and around the world. The Bulletin contains:

- *Highlights of major climatic events and anomalies.*
- *U.S. climatic conditions for the previous week.*
- *U.S. apparent temperatures (summer) or wind chill (winter).*
- *Global two-week temperature anomalies.*
- *Global four-week precipitation anomalies.*
- *Global monthly temperature and precipitation anomalies.*
- *Global three-month precipitation anomalies (once a month).*
- *Global twelve-month precipitation anomalies (every three months).*
- *Global three-month temperature anomalies for winter and summer seasons.*
- *Special climate summaries, explanations, etc. (as appropriate).*

Most analyses contained in this Bulletin are based on preliminary, unchecked data received at the Climate Analysis Center via the Global Telecommunications System. Similar analyses based on final, checked data are likely to differ to some extent from those presented here.

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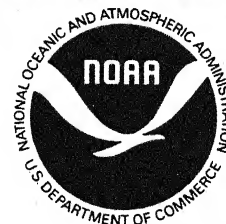
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GLOBAL CLIMATE HIGHLIGHTS

MAJOR CLIMATIC EVENTS AND ANOMALIES AS OF DECEMBER 14, 1991

1. Southeastern Pacific:

TROPICAL CYCLONES HAMMER SOUTH PACIFIC ISLANDS.

Severe Cyclone Val smashed into the islands of Western and American Samoa with winds of up to 260 kph and even higher gusts. A dozen people were reported killed on Western Samoa with 80% of the homes devastated. On American Samoa, hundreds were injured, thousands left homeless, and nearly all crops were wiped out, according to press reports. Farther to the east, Cyclone Wasa struck the Society Islands with winds up to 193 kph and heavy rains (200 mm), producing mudslides on Moorea Island that took two lives [Episodic Events].

2. Western Hawaii:

TORRENTIAL RAINS DRENCH KAUAI ISLAND.

Up to 380 mm of rain fell during a 24-hour period ending late Saturday, flooding portions of Kauai. Three people were killed, 50 houses were destroyed along the Anahola River in the northeastern corner of the island, and damage was estimated at \$7.1 million, according to press reports [Episodic Event].

3. Western United States:

LIGHT RAIN DAMPENS SOUTHERN CALIFORNIA.

Although rainshowers dropped 3 to 20 mm on southern California, little or no precipitation fell across the remainder of the state. Similar to the past five autumns, substantial rains have been slow to materialize across the state [6 weeks].

4. Central United States:

MORE PRECIPITATION KEEPS CENTRAL STATES WET.

Several storms systems moved across the Mississippi Valley and Great Lakes, once again bringing above normal precipitation to much of the nation's midsection. Amounts of 8 to 50 mm fell from eastern Nebraska to upper Michigan, while amounts of 40 to 155 mm prolonged or renewed flooding in parts of the Tennessee, Ohio, and lower Mississippi Valleys, according to the Office of Hydrology. [8 weeks].

5. Southeastern United States:

NO RELIEF FROM DRYNESS.

Little or no rain from the eastern Carolinas southward to Florida kept much of the southern Atlantic region dry. Since early November, many locations have received 50-120 mm less than normal precipitation [11 weeks].

6. Central and Southeastern Europe and the Eastern Mediterranean.

COLD WAVE BLASTS REGION.

Bitterly cold air invaded much of Europe behind fierce winter storms that pounded the eastern Mediterranean the previous week (see page 6). Weekly temperatures ranged from 3°C to 11°C below normal from England to southern Egypt [2 weeks].

7. Southeastern Europe and the Middle East.

HEAVY PRECIPITATION INUNDATES AREA.

One of Romania's heaviest snowfalls in years dumped 76 cm on Bucharest in 24 hours on Monday and Tuesday and left much of the nation without transportation. In Turkey, snowstorms paralyzed much of the country as the cold snap reportedly caused several deaths. To the southeast, flash floods triggered by heavy rain in eastern Iran left 22 people dead and damaged crops in five provinces. The Persian Gulf port of Bushehr experienced large hailstones that smashed windows while some 400 villages near Khorramabad were cut off by heavy snow in the Zagros Mountains, according to press reports [Episodic Event].

8. East-Central China:

DRYNESS CONTINUES.

Little or no rain was reported across the North China Plain Wheat Belt. Although normal amounts are relatively low during late autumn and winter, moisture deficits of 50-70 mm have accumulated across the southern regions since early November. [12 weeks].

9. Malaysia:

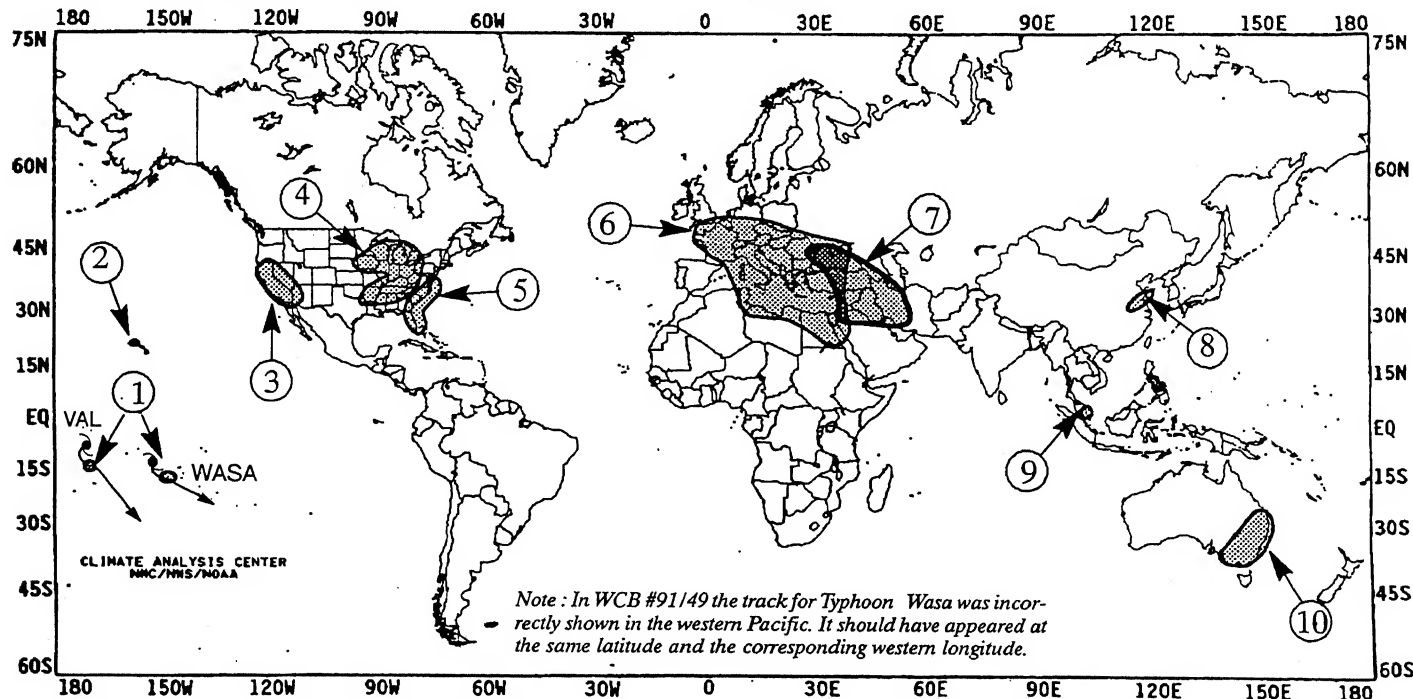
TROPICAL SHOWERS DRENCH NATION.

Continuous rain, up to 460 mm in three days, deluged portions of eastern Malaysia, flooding rivers and submerging some main roads, according to press reports [Episodic Event].

10. Southeastern Australia:

HEAVY RAINS SOAK NORTHERN AREAS, DRYNESS REMAINS IN THE SOUTH

Moderate to heavy rains (20-290 mm) spread across southern Queensland and New South Wales, easing prolonged drought but causing flooding in some areas. Little or no rain, however, fell over much of Victoria as dryness continued in that state [20 weeks].



EXPLANATION

TEXT: Approximate duration of anomalies is in brackets. Precipitation amounts and temperature departures are this week's values.

MAP: Approximate locations of major anomalies and episodic events are shown. See other maps in this Bulletin for current two week temperature anomalies, four week precipitation anomalies, long-term anomalies, and other details.

UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF DECEMBER 8 – 14, 1991

Unseasonably mild weather dominated much of the nation as many locations observed conditions more representative of late spring than early winter. Readings topped 70°F as far north as central Illinois and New Jersey, and temperatures even surpassed 80°F in eastern North Carolina. Nearly fifty daily record highs were established from Texas to Connecticut. In the nation's midsection, strong thunderstorms rocked portions of the Midwest southward to the western Gulf Coast, spawning heavy rain, hail, and tornadoes. Over five inches of rain soaked Beaumont/Port Arthur, TX on Friday while copious rains from strong thunderstorms flooded roads and bridges in Louisiana and Mississippi. Meanwhile, wintry weather was confined to the Rockies and the upper Midwest. Nearly half a foot of snow blanketed the Rockies from New Mexico to portions of Wyoming. In the upper Midwest, a late-week storm system generated blizzard-like conditions across parts of North Dakota, Minnesota, Wisconsin, and Michigan. Over half a foot of snow whitened northern Minnesota and Michigan with winds gusting to 50 mph, producing dangerously low wind chills. In the Southwest, over 2 inches of rain drenched central Arizona late Tuesday and Wednesday, leaving water standing on some roads. Farther north, a storm system tracked through the Gulf of Alaska, bringing blizzard conditions to the Seward Peninsula. In Hawaii, over 15 inches of rain deluged the island of Kauai, especially northeastern sections, generating mudslides and severe flooding that took three lives and caused an estimated \$7.1 million in damages.

The week began with a dome of high pressure dominating the western half of the nation while a cold front tracked across the nation's midsection. Thunderstorms packing heavy rains, baseball-size hail, and tornadoes developed along and ahead of the front as it pushed slowly eastward. To the north, dense fog and freezing drizzle enveloped portions of the Great Lakes and upper Midwest. Ahead of the frontal system, unseasonably mild conditions prevailed, producing nearly a dozen daily record highs in the East on Monday. Farther west, an upper-air disturbance off the California coast spread light rain from southern California to central Arizona and generated wind gusts to 50 mph in San Francisco.

During the last half of the week, the front in the middle of the country pushed off the Atlantic Coast while the disturbance off the California coast drifted into the Southwest. The system dumped heavy rains on parts of Arizona and spread snow across the southern and central Rockies. The low eventually moved into the nation's midsection and intensified as it moved northeastward. The storm produced wintry weather in the upper Midwest and northern Plains, with heavy snow and wind chills to -30°F across parts of Minnesota and

upper Michigan. To the west of the storm system, blowing and drifting snow and temperatures in the single digits were common. The system's associated cold front tracked rapidly eastward across the Ohio Valley, accompanied by thunderstorms and wind gusts in excess of 60 mph in Pennsylvania that downed trees and power lines and toppled a 70-foot tower in Mount Lebanon. Ahead of the front, record warmth persisted with more than a dozen daily record highs from Florida to Connecticut on Friday and Saturday.

According to the River Forecast Centers, the greatest weekly totals (more than 6 inches) occurred in a narrow band from extreme southeastern Texas to east-central Louisiana (Table 1). Amounts exceeding 2 inches were also measured in the eastern half of Texas northeastward through the already-saturated lower Mississippi and Tennessee Valleys to the central Appalachians, where persistent heavy rains have dropped over 20 inches during the past 4 weeks (Figure 1). In addition, heavy precipitation also occurred at widely-scattered locations in the Far West, Alaska, and Hawaii. Light to moderate amounts were recorded along the Pacific Northwest Coast, in the northern Cascades and Rockies, from southern California eastward to the southern Plains, and throughout much of the eastern half of the U.S. Little or no precipitation fell along the southern Atlantic Coast, on the remainder of California, the central and northern Intermountain West, central Rockies, and parts of the northern and central Plains.

As previously mentioned, extremely mild air enveloped most of the nation (Table 2). Weekly departures between +12°F and +15°F were observed from the lower Mississippi Valley to southern Maine and along the Southeast coast. Departures of +6°F to +12°F were common from the Great Plains across the remainder of the eastern half of the U.S. and portions of the northern Rockies. Weekly departures of +2°F to +6°F were prevalent across most of the Pacific Northwest, central and southern Rockies, and southern California. In Alaska, abnormally mild conditions prevailed across the south and east-central portions with weekly departures of +5°F to +10°F. Abnormal warmth also affected Hawaii where temperatures averaged between 2°F and 4°F above normal.

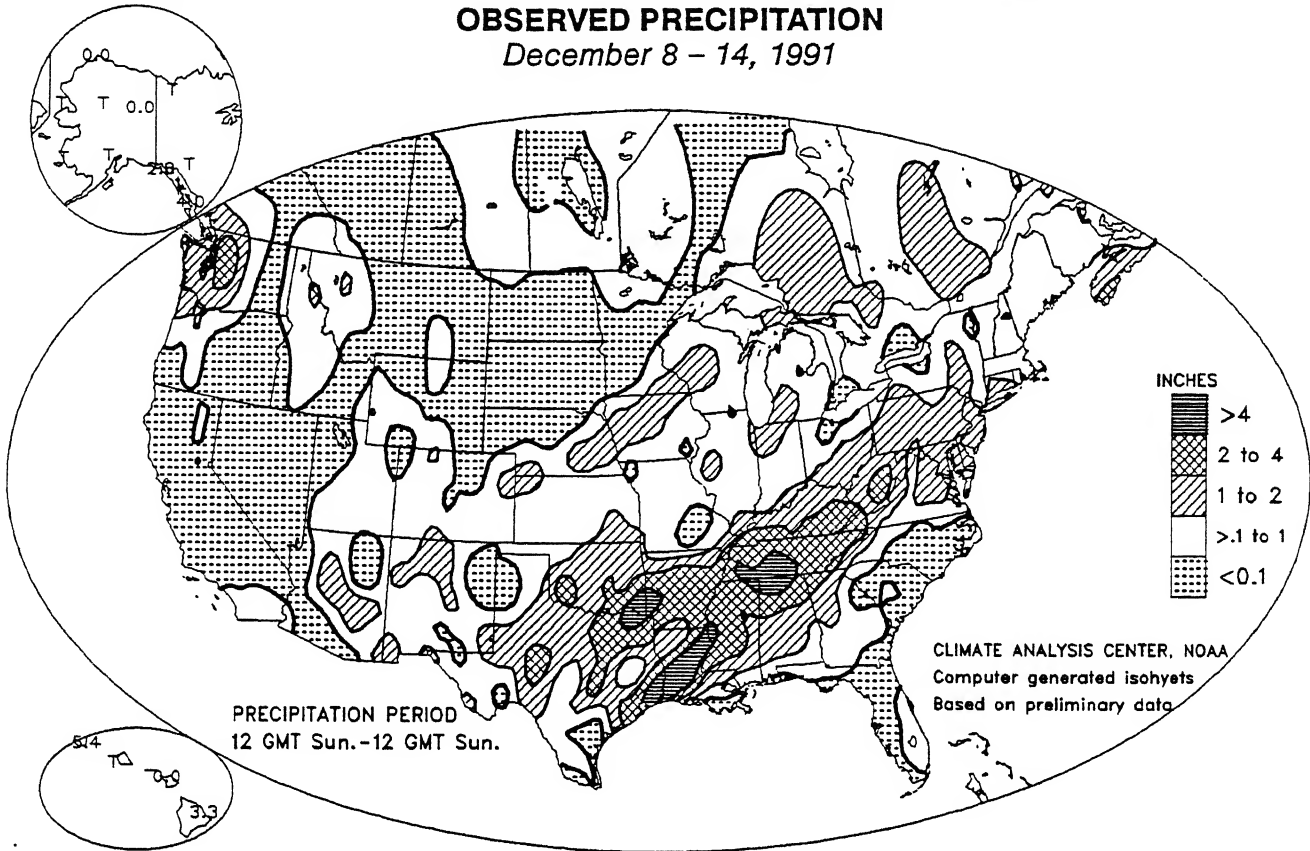
Subnormal temperatures were confined along the Pacific Coast, in the Great Basin, and at scattered locations in the central Rockies (Table 3). Weekly departures between -2°F and -5°F were limited to the Great Basin and a few West Coast locations while the remaining areas were slightly below normal. Colder than usual weather also affected the remainder of Alaska; however, the largest negative departure was only -5°F (at Nome).

TABLE 1. SELECTED STATIONS WITH 2.50 OR MORE INCHES OF PRECIPITATION DURING THE WEEK OF DECEMBER 8 – 14, 1991

STATION	TOTAL (INCHES)	STATION	TOTAL (INCHES)
PORT ARTHUR, TX	8.11	HOPKINSVILLE/CAMPBELL AAF, KY	2.95
STAMPEDE PASS, WA	5.96	SITKA, AK	2.95
LIHUE, KAUAI, HI	5.37	CROSSVILLE, TN	2.89
ALEXANDRIA/ENGLAND AFB, LA	4.52	GALVESTON, TX	2.85
ANNETTE ISLAND, AK	3.95	YAKUTAT, AK	2.80
MEMPHIS NAS, TN	3.73	PINE BLUFF, AR	2.79
MUSCLE SHOALS, AL	3.52	ILIAMNA, AK	2.78
HUNTSVILLE, AL	3.47	FT WORTH/CARSWELL AFB, TX	2.69
QUILLAYUTE, WA	3.40	HOBART, OK	2.59
HILO/LYMAN, HAWAII, HI	3.30	LONDON/CORBIN, KY	2.55
JACKSON, TN	3.07	TUPELO, MS	2.51
GREENWOOD, MS	3.00	MEMPHIS, TN	2.50

OBSERVED PRECIPITATION

December 8 - 14, 1991



DEPARTURE OF AVERAGE TEMPERATURE FROM NORMAL (°F)

December 8 - 14, 1991

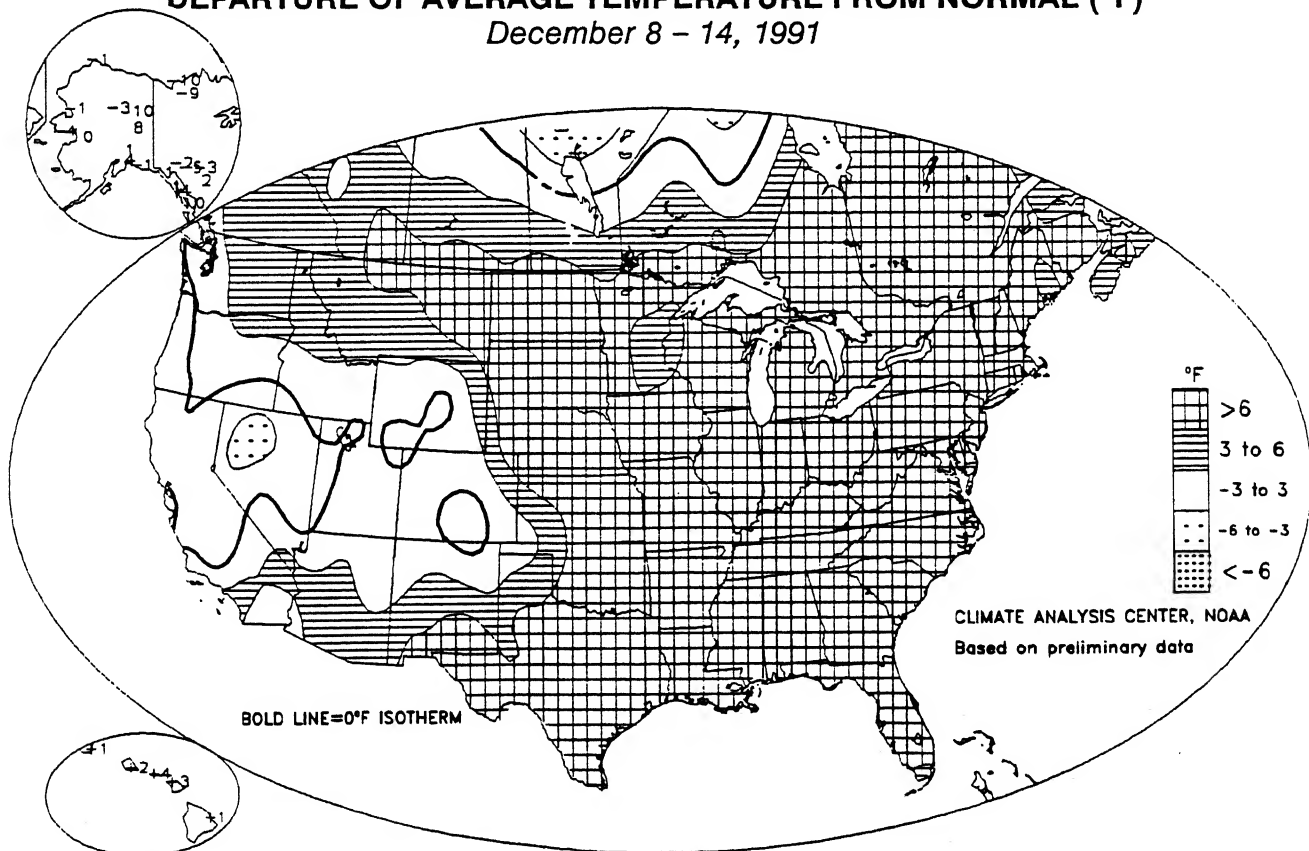


TABLE 2. SELECTED STATIONS WITH TEMPERATURES AVERAGING 13.0°F OR MORE ABOVE NORMAL FOR THE WEEK OF DECEMBER 8 - 14, 1991

<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
ALTOONA, PA	+15.8	46.1	UTICA, NY	+13.8	40.8
MONTPELIER, VT	+15.0	37.1	ERIE, PA	+13.5	45.8
ST LOUIS, MO	+14.8	50.4	SYRACUSE, NY	+13.4	43.4
BRADFORD, PA	+14.8	40.8	LEBANON, NH	+13.4	37.3
BINGHAMTON, NY	+14.4	41.9	ALBANY, NY	+13.3	41.3
ZANESVILLE, OH	+14.1	47.1	PROVIDENCE, RI	+13.2	46.8
ROLLA, MO	+14.0	49.7	INDIANAPOLIS, IN	+13.2	46.1
PITTSBURGH, PA	+14.0	47.0	ELKINS, WV	+13.2	46.1
BEEVILLE NAS, TX	+13.9	70.4	FINDLAY, OH	+13.2	43.9
HARTFORD, CT	+13.9	44.5	COLUMBUS, OH	+13.1	46.4
WORCESTER, MA	+13.9	42.3	PARKERSBURG/WOOD CO, WV	+13.0	49.6
YOUNGSTOWN, OH	+13.8	44.5			

TABLE 3. SELECTED STATIONS WITH TEMPERATURES AVERAGING 2.0°F OR MORE BELOW NORMAL FOR THE WEEK OF DECEMBER 8 - 14, 1991

<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
ALAMOSA, CO	-8.8	10.8	BETTLES, AK	-3.1	-10.7
NOME, AK	-4.7	0.3	EUREKA, CA	-2.6	46.1
CALIENTE, NV	-4.3	30.3	SACRAMENTO, CA	-2.4	43.7
WINNEMUCCA, NV	-3.5	27.6	STOCKTON, CA	-2.3	43.5
LOVELOCK, NV	-3.2	27.6	NORTH BEND, OR	-2.2	44.8
MARYSVILLE/YUBA CO, CA	-3.2	43.6	OGDEN/HILL AFB, UT	-2.1	28.6
BAKERSFIELD, CA	-3.2	45.4	MCGRATH, AK	-2.1	-10.2

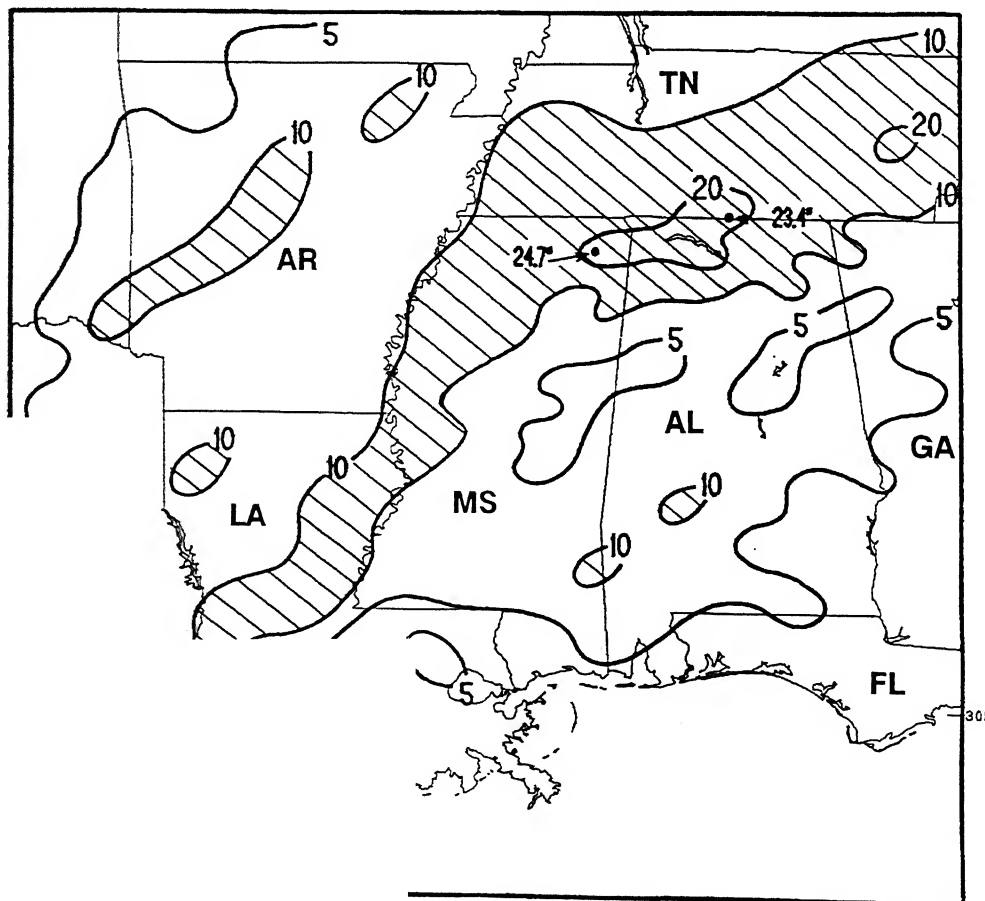
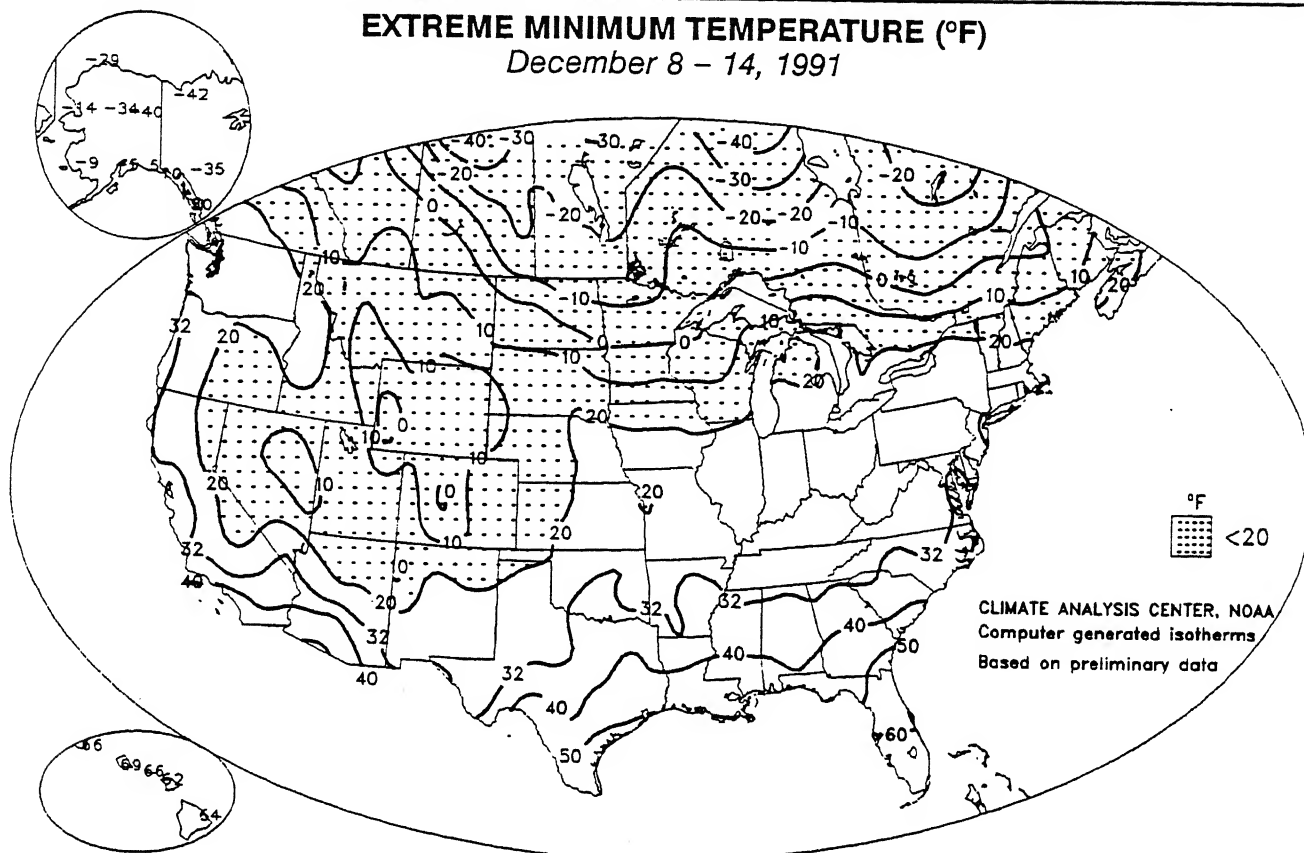


FIGURE 1. Total Precipitation (inches) during November 17 - December 14, 1991. Isohyets drawn only for 5, 10, and 20 inches, with shaded areas greater than 10 inches. Numerous slow moving frontal systems have drenched much of the Tennessee and lower Mississippi Valleys with heavy rain, prolonging or renewing widespread river flooding. Over 20 inches of rain has accumulated in portions of northern Mississippi, northern Alabama, and central Tennessee during the last four weeks.

EXTREME MINIMUM TEMPERATURE (°F)

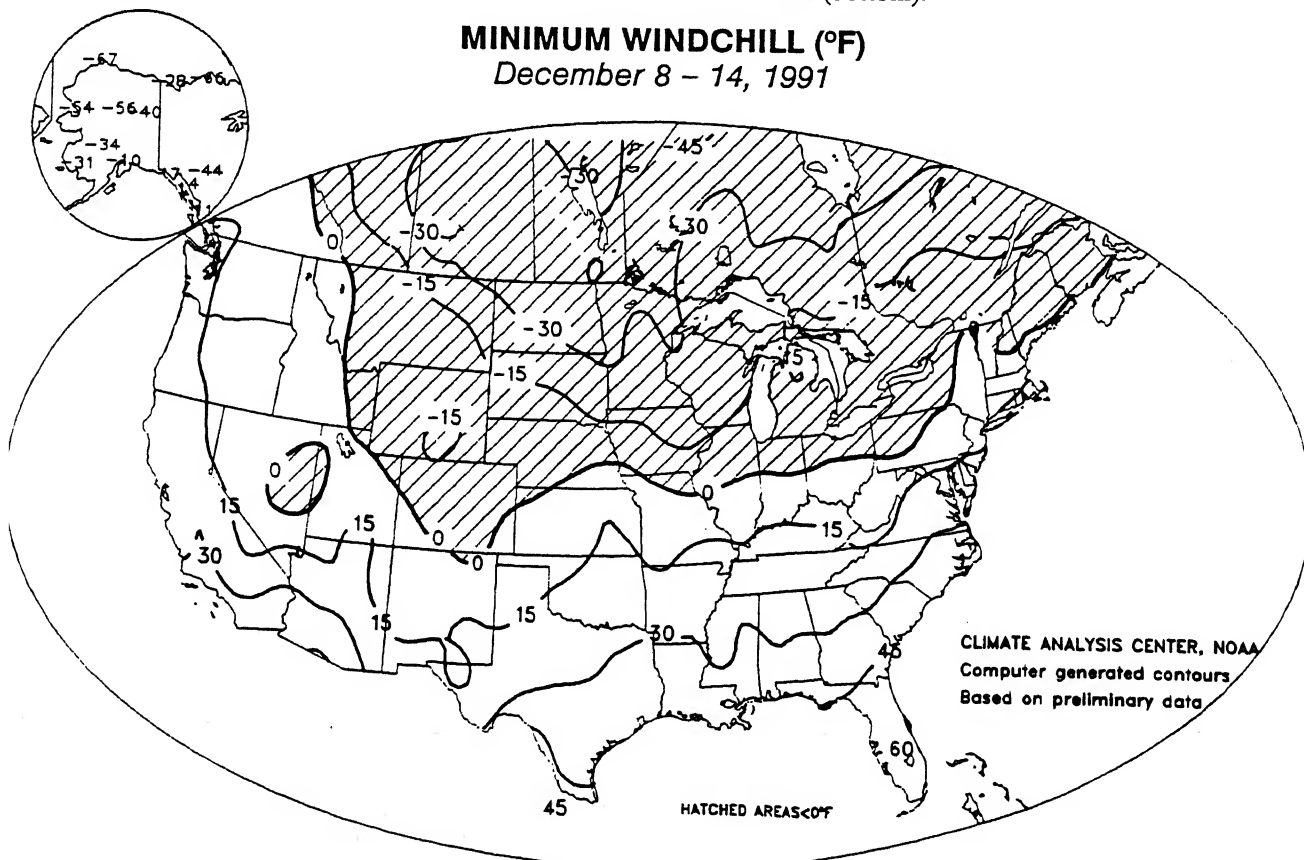
December 8 - 14, 1991



atively mild weather prevailed throughout much of the nation as temperatures remained above freezing across most of the p South and mid-Atlantic and Pacific Coasts (top). Late in the week, a blast of Arctic air and high wind brought dangerous l chills ($< -15^{\circ}\text{F}$) from the northern Plains to the western Great Lakes (bottom).

MINIMUM WINDCHILL (°F)

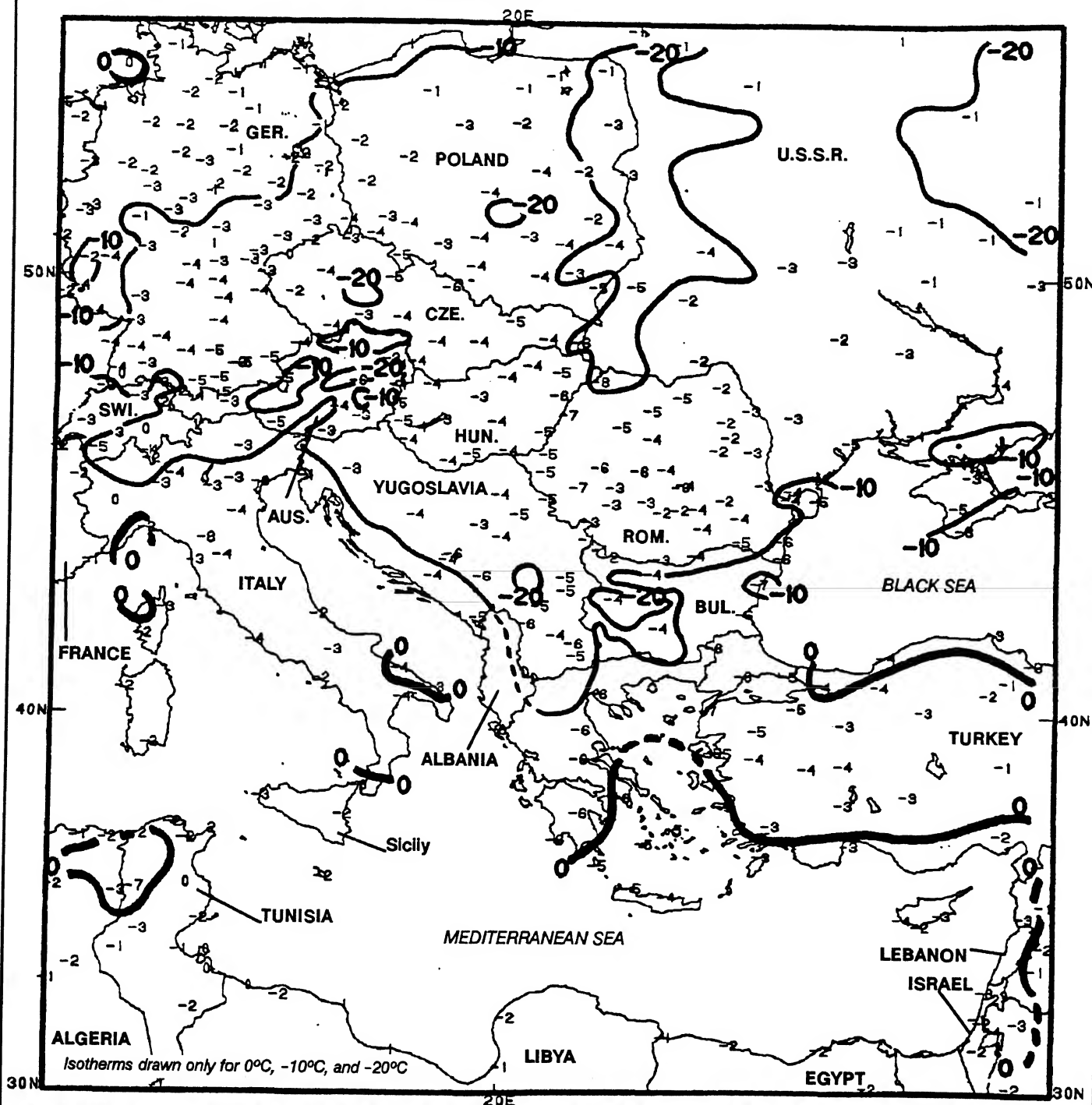
December 8 - 14, 1991



CLIMATE HIGHLIGHTS FEATURE

CONTOURS: EXTREME MINIMUM TEMPERATURE (°C)
PLOTTED VALUES: DEPARTURE FROM NORMAL AVERAGE TEMPERATURE (°C)

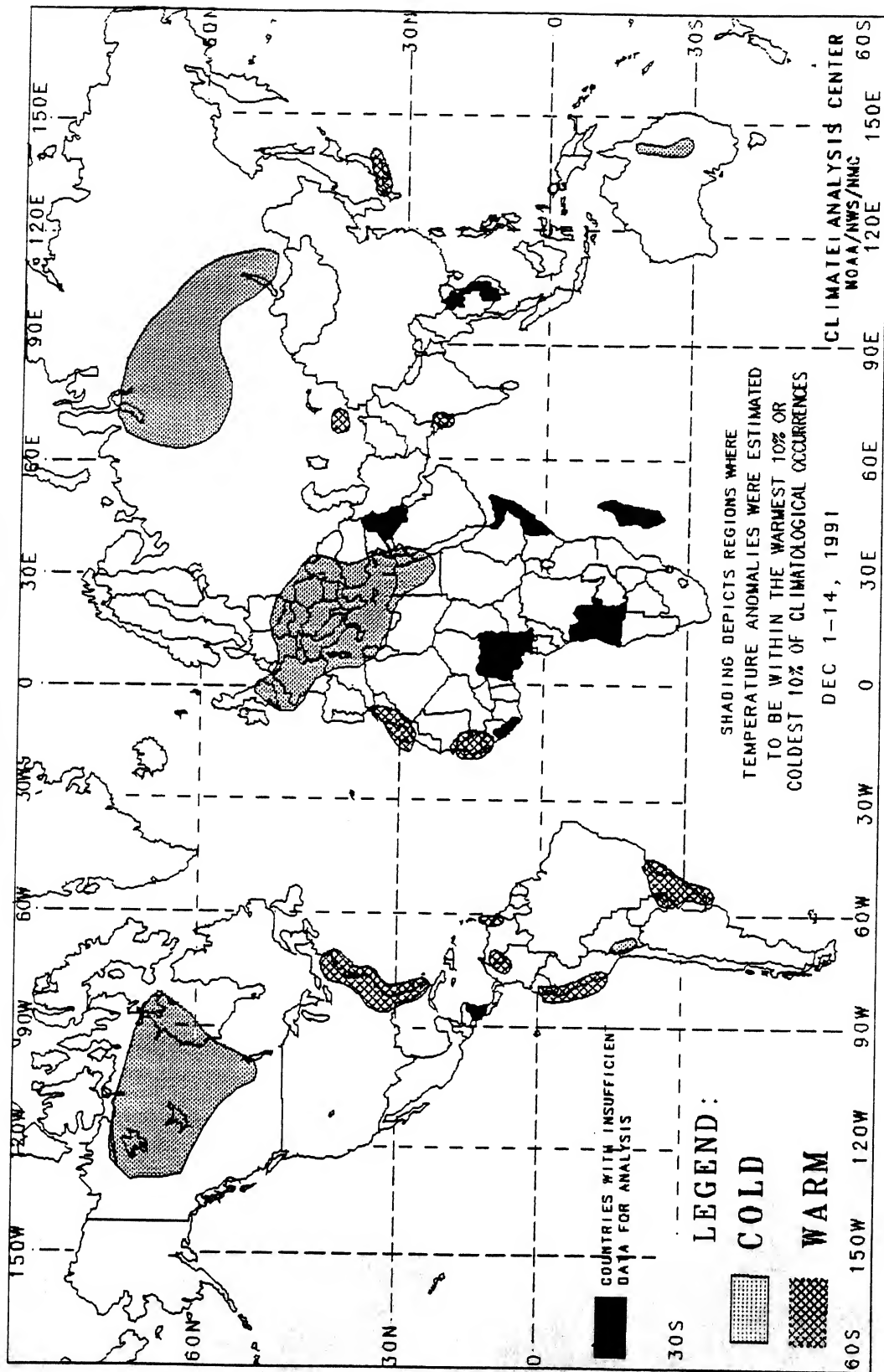
December 1 - 14, 1991



Arctic air has swept into much of central and eastern Europe and the eastern Mediterranean Basin during the last two weeks, generating daily temperatures as much as 17°C below normal in Poland. The mercury dropped to -17°C at Munich, Germany, which was the lowest reading during early December since 1879. Farther east, heavy snows and 100 kph winds battered Romania, closing many roads and railways. A Romanian freighter sank off the coast of Sicily during one storm, taking the lives of ten seamen. Deep snow isolated hundreds of towns in eastern Turkey, and significant snowfall was measured in Beirut, Lebanon for the first time in thirty years.

2-WEEK GLOBAL TEMPERATURE ANOMALIES

DECEMBER 1 - 14, 1991



The anomalies on this chart are based on approximately 2500 observing stations for which at least 13 days of temperature observations were received from synoptic reports. Many stations do not operate on a twenty-four hour basis so many night time observations are not taken. As a result of these missing observations the estimated minimum temperature may have a warm bias. This in turn may have resulted in an overestimation of the extent of some warm anomalies.

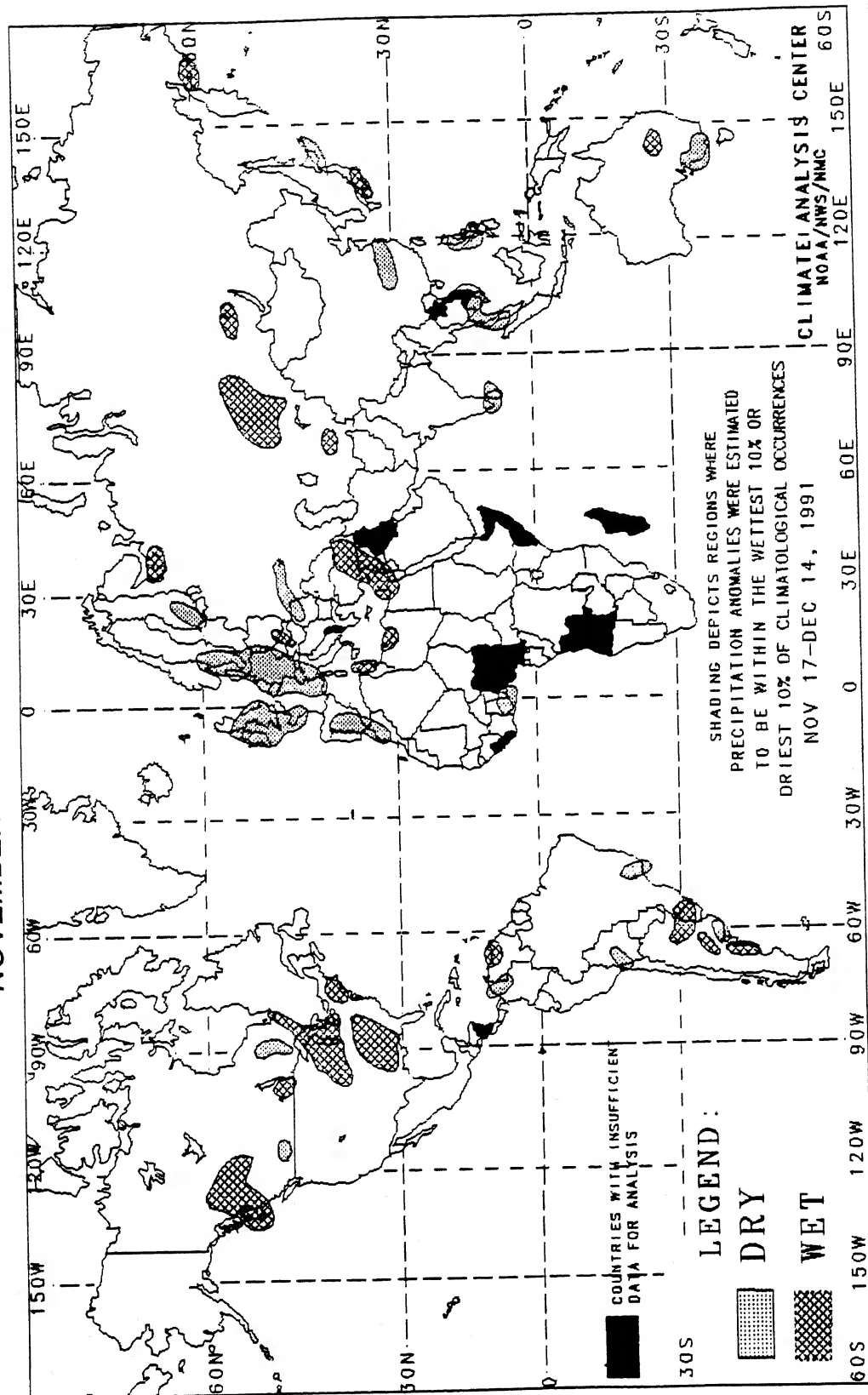
Temperature anomalies are not depicted unless the magnitude of temperature departures from normal exceeds 1.5°C.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

This chart shows general areas of two week temperature anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

4-WEEK GLOBAL PRECIPITATION ANOMALIES

NOVEMBER 17 - DECEMBER 14, 1991



In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of four week precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the four week period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total four week precipitation exceeds 50 mm.

UNITED STATES SEASONAL CLIMATE SUMMARY

AUTUMN 1991

In the Far West, rains usually begin increasing during October or November. This Fall, however, the rainy season failed to become well established until November in the Pacific Northwest, and never fully materialized across California. This sixth consecutive slow start to the wet season, accompanied by warm and occasionally windy weather, induced destructive wildfires and dust storms. Particularly destructive fires swept through parts of the Oakland, CA area, taking 23 lives and causing an estimated \$5.2 billion in damages. In late November, a blinding dust storm caused more than 100 cars to crash on Interstate 5 near Coalinga, CA in the San Joaquin Valley. Seventeen lives were lost, and over 150 people were injured in the fiery pileup. In contrast, powerful storms brought above normal precipitation, heavy snow, and high wind to the Intermountain West, Rockies, northern Plains, central High Plains, Midwest, and Northeast. A number of locations in the Midwest and central High Plains set new November snowfall records with Minneapolis, MN establishing an all-time monthly record of 46.9". Frontal systems associated with these storms brought severe weather and torrential rains to portions of the southeastern Plains and middle and lower Mississippi Valley. Further east, prolonged dry conditions, dating back to early spring in some areas, induced wildfires in the central and southern Appalachians and Piedmont, but cooler and damper weather in November helped suppress these fires. Despite several blasts of polar air, temperatures across Alaska averaged above normal, except in the far north, while above normal temperatures and below normal rainfall prevailed in Hawaii.

Autumn 1991 commenced with record heat spreading across the eastern two-thirds of the country. Philadelphia, PA set a new record for the number of 90°F (or greater) days in a year. The transition from summer to autumn came abruptly in mid-September when a strong cold front pushed across the nation's midsection and eastern seaboard. Record cold followed in the wake of the front, with numerous stations in the Midwest recording the lowest readings for so early in autumn, while locations ahead of the front from the Southeast to New England reported record highs far so late in the year. Anomalous warmth persisted in the West, particularly during the latter half of the month. Temperatures averaged more than 4°F above normal in interior California and topped the century mark in northern California at month's end. The dry heat established ideal wildfire conditions across the Far West as 1200 acres were scorched in California's Shasta-Trinity National Forest. Heavy showers drenched portions of the central Rockies, southern Plains, upper Mississippi Valley, and New England, resulting in severe flooding in northern Utah and along the Rio Grande River. In contrast, dry weather remained from the central Plains to the central Appalachians and mid-Atlantic. Heavy rains soaked southeastern Alaska and eastern Hawaii, but dry weather continued in northeastern Alaska and western Hawaii.

October's weather was highlighted by strong storm systems that brought heavy precipitation to the northern and central Rockies, the eastern Great Plains, the Mississippi Valley, the Great Lakes and the Northeast. Thunderstorms (due in part to Tropical Storm Fabian) also drenched southern Florida, causing localized flooding but providing the Everglades with needed moisture. In contrast, dry weather exacerbated moisture shortages in the Pacific Northwest, central Plains, central and southern Appalachians, and mid-Atlantic. Anomalous warmth accompanied the dry conditions and contributed to wildfire outbreaks in the northwestern quarter of the nation and in the central and southern Appalachians and Piedmont. A large Pacific storm ushered cooler and wetter weather into the Pacific Northwest, suppressing the wildfires that had charred the region. At

month's end, a strong winter storm spread heavy snow and bitter cold from the Rockies to the Great Lakes. Up to 3 feet of snow and 50 mph winds produced blizzard conditions across the upper Midwest. Meanwhile, a huge Atlantic storm (fueled by moisture from the remnants of Hurricane Grace) caused widespread coastal flooding and beach erosion from Maine to the Carolinas.

Similar to the previous month, November 1991 featured a succession of disturbances that tracked through the nation's midsection, bringing record snowfall, freezing rain, and frigid air to the upper Midwest while severe weather and heavy rain pummeled portions of the middle and lower Mississippi and Tennessee Valleys, the Appalachians, and the central Gulf coast. Storm systems also moved from the Pacific Northwest and Intermountain West into the Rockies and Plains, generating heavy rain and snow (depending on elevation). An intense Pacific storm at mid-month spawned a rare Pacific Northwest thunderstorm outbreak, with lightning and wind gusts up to 80 mph, that caused numerous power outages in western Washington. Dry weather, however, prevailed across California and the middle and southern Atlantic seaboard, aggravating long-term dryness in both regions.

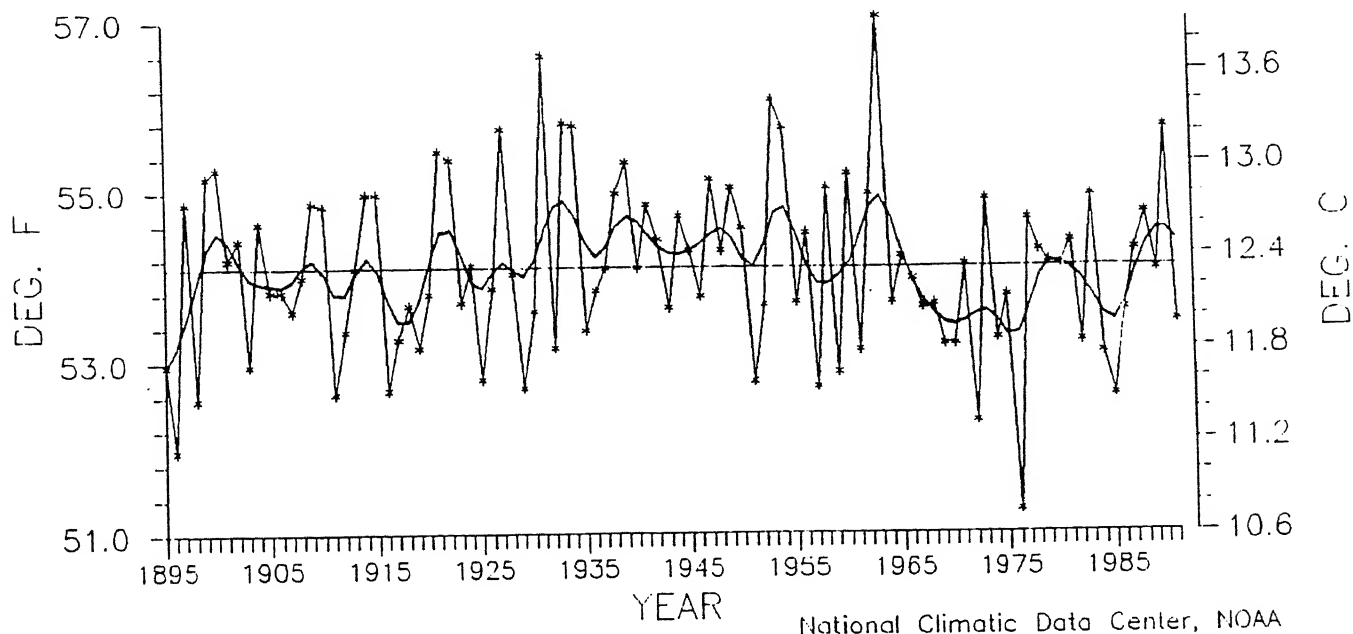
According to the River Forecast Centers, the greatest seasonal precipitation (more than 12 inches) fell from the southern Plains to the middle Mississippi and Tennessee Valleys, along the western and central Gulf and northern Pacific coasts, through the Northeast, the Midwest, Florida, southern Alaska, and eastern Hawaii, and in scattered sections of the central Rockies and Appalachians (Table 1). Above normal seasonal precipitation was found over most of the Intermountain West, Rockies, northern and southern Plains, Mississippi Valley, Great Lakes, southern and western Alaska, and parts of the Northeast, central Appalachians, and Florida (page 12, Figure 2). Regionally, the East North Central had the 8th wettest autumn on record (page 11), while four states [IL, MN, UT, WI] had one of the ten wettest autumns on record (page 16). Nationally, 1991 ranked as the 32nd wettest autumn, based on the standardized precipitation index (page 10).

In contrast, an atypically dry Autumn [$< 75\%$ of normal] afflicted much of the Pacific coast, central Plains, mid-Atlantic, Southeast, Hawaii, northern Alaska, and portions of the Ohio Valley and northern and southern Plains (page 13). The Southeast region had the 7th driest autumn with the West and Northwest also ranking in the lower third of the historical distribution (page 11). Four states [CA, FL, GA, and SC] had one of the ten driest autumns since 1895.

In the contiguous U.S., above normal temperatures covered much of the western and eastern thirds of the country. Abnormally warm air enveloped the Far West, where departures ranged from +2°F to +4°F (Table 3). Temperatures also averaged above normal over most of Alaska and Hawaii. The West region had its 2nd warmest autumn on record, but was the only region to rank in the upper third of the historical distribution (page 11). Both California and Arizona had one of the ten warmest autumns since 1895 (page 16).

Colder than usual conditions prevailed in the Rockies, Great Plains, northern Alaska, and much of the Mississippi Valley and Great Lakes. The Great Plains, upper Mississippi Valley, and upper Great Lakes averaged 2°F to 4°F below normal during September - November, 1991 (page 15). Nationally, Autumn 1991 ranked as the 26th coldest autumn in the last 97 years (page 10). The East North Central had its 7th coldest autumn on record while 3 states (IA, MN, and TX) ranked among the ten coldest, according to the National Climatic Data Center (page 16).

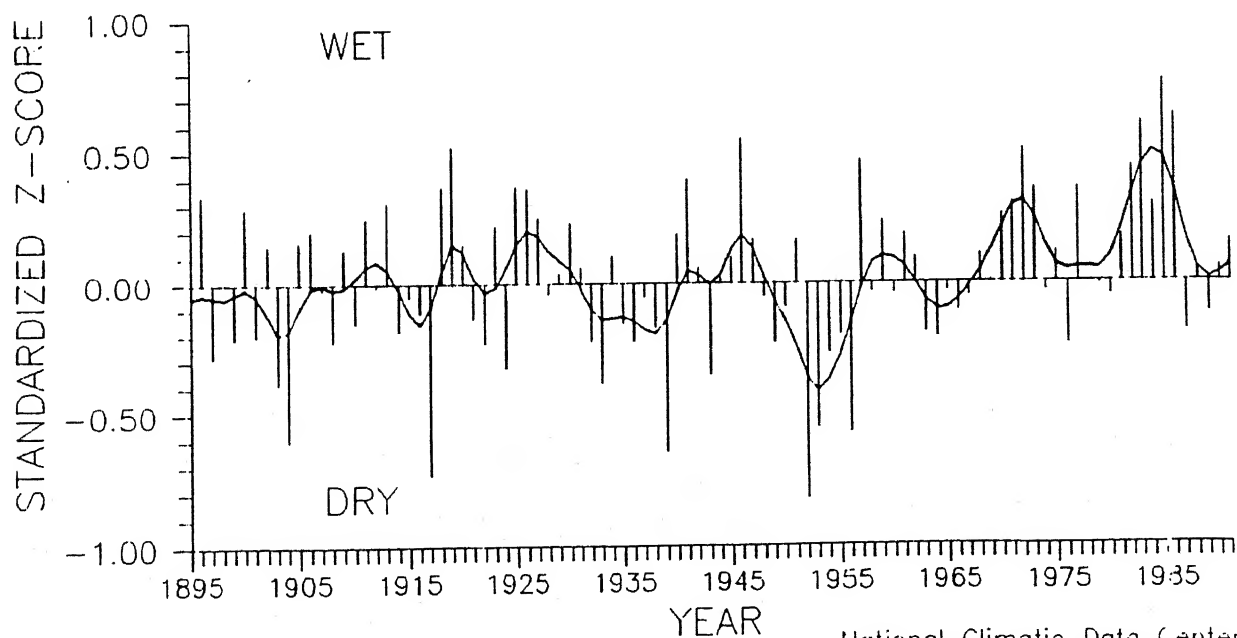
U.S. NATIONAL TEMPERATURE AUTUMN, 1895-1991



National Climatic Data Center, NOAA

Nationally Averaged Autumn (September - November) Temperatures 1895 - 1991, as Computed by the National Climatic Data Center. *Autumn 1991 ranked as the 26th coldest autumn on record, and was the first in the last five years to average significantly below normal.*

U.S. NATIONAL WEIGHTED MEAN PRECIPITATION INDEX SEP-NOV, 1895-1991



National Climatic Data Center, NOAA

National Mean Autumn (September - November) Precipitation Index, 1895-1991, as Computed by the National Climatic Data Center. *Autumn 1991 ranked above the median as the 32nd wettest autumn on record. This index takes local normals into account so that typically wet regions do not dominate the index value.*

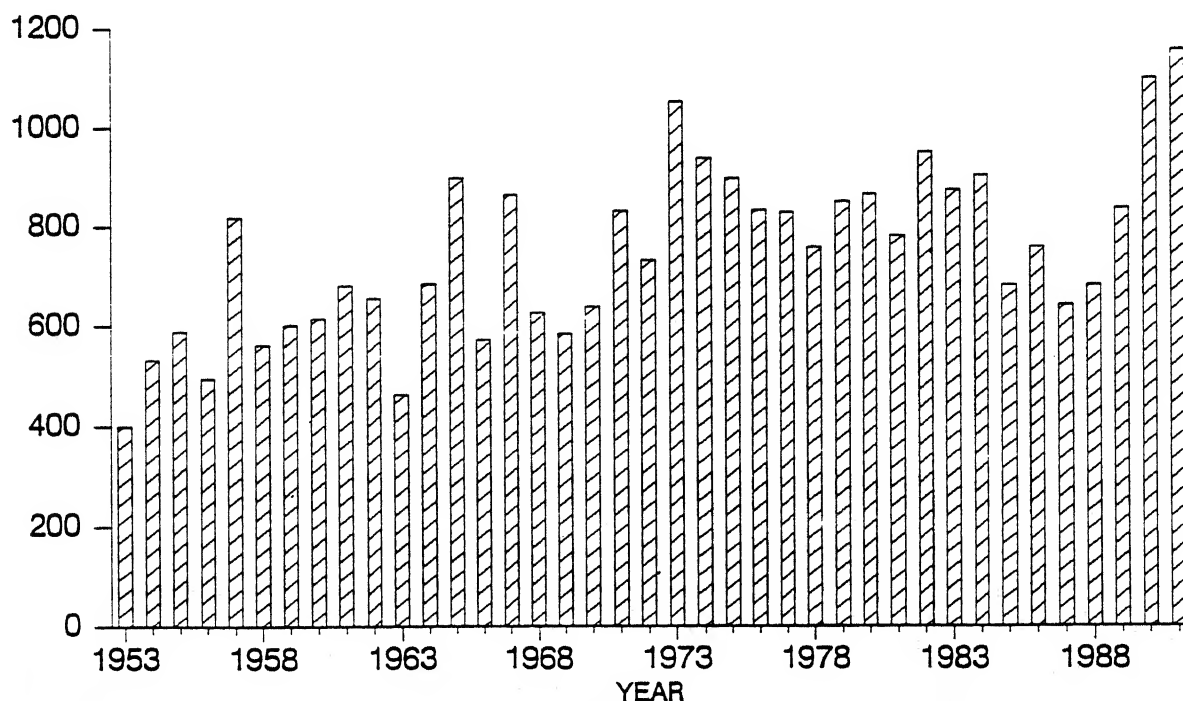
TEMPERATURE AND PRECIPITATION RANKINGS FOR SEP-NOV 1991, BASED ON THE PERIOD 1895 TO 1991. 1 = DRIEST/COLDEST AND 97 = WETTEST/HOTTEST.

<u>REGION</u>	<u>PRECIPITATION</u>	<u>TEMPERATURE</u>
NORTHEAST	48	57
EAST NORTH CENTRAL	90	7
CENTRAL	65	32
SOUTHEAST	7	37
WEST NORTH CENTRAL	62	19
SOUTH	68	14
SOUTHWEST	80	47
NORTHWEST	27	58
WEST	19	96
NATIONAL	66	26

National Climatic Data Center

TOTAL NUMBER OF TORNADES, U.S.

JANUARY-NOVEMBER TOTAL, 1953-1991



National Climatic Data Center, NOAA

According to preliminary data from the National Weather Service, there were 74 tornadoes across the United States during autumn 1991, which is below the 1953 – 1990 average of 88. Overall, however, preliminary data indicate that 1155 tornadoes have touched down this year, the most since records began in 1953. It should be noted that the preliminary count is generally higher than the final count. In 1991, for example, the preliminary count overestimated the final total by 19 percent.

TABLE 1. SELECTED STATIONS WITH 150% OR MORE OF THE NORMAL PRECIPITATION AND 13.00 INCHES OR MORE PRECIPITATION; OR, STATIONS WITH 20.00 INCHES OR MORE PRECIPITATION AND NO NORMALS DURING AUTUMN 1991.

<u>STATION</u>	<u>TOTAL (INCHES)</u>	<u>PCT. OF NORMAL</u>	<u>STATION</u>	<u>TOTAL (INCHES)</u>	<u>PCT. OF NORMAL</u>
YAKUTAT, AK	79.41	154.5	HOUGHTON LAKE, MI	14.79	202.3
KODIAK, AK	35.54	187.2	MILWAUKEE, WI	14.75	209.2
MIAMI, FL	34.01	190.5	PEORIA, IL	14.50	178.8
JUNEAU, AK	32.56	169.5	FT WAYNE, IN	14.33	187.1
HOMESTEAD AFB, FL	24.50	***	SOUTH BEND, IN	14.22	154.6
KEY WEST NAS, FL	20.94	***	SPRINGFIELD, IL	14.10	182.2
HARRISON, AR	19.76	200.0	PARK FALLS, WI	13.67	170.9
MONROE, LA	19.76	200.0	ROCKFORD, IL	13.60	153.5
OKLAHOMA CITY, OK	17.78	232.1	FT SILL/HENRY POST AAF, OK	13.49	170.3
FT SMITH, AR	17.68	178.4	CHICAGO/O'HARE, IL	13.47	164.1
DULUTH, MN	17.11	241.3	MOLINE, IL	13.36	160.0
CAPE GIRARDEAU, MO	15.06	152.9	EAU CLAIRE, WI	13.33	190.4
DALLAS-FT WORTH, TX	14.96	176.2	MADISON, WI	13.26	187.6
GRAND RAPIDS, MI	14.96	171.2	MINNEAPOLIS, MN	13.23	236.7
ILIAMNA, AK	14.95	177.6	WICHITA FALLS, TX	13.04	176.9
MUSKEGON, MI	14.89	174.8			

NOTE: Stations without precipitation normals are indicated by asterisks.

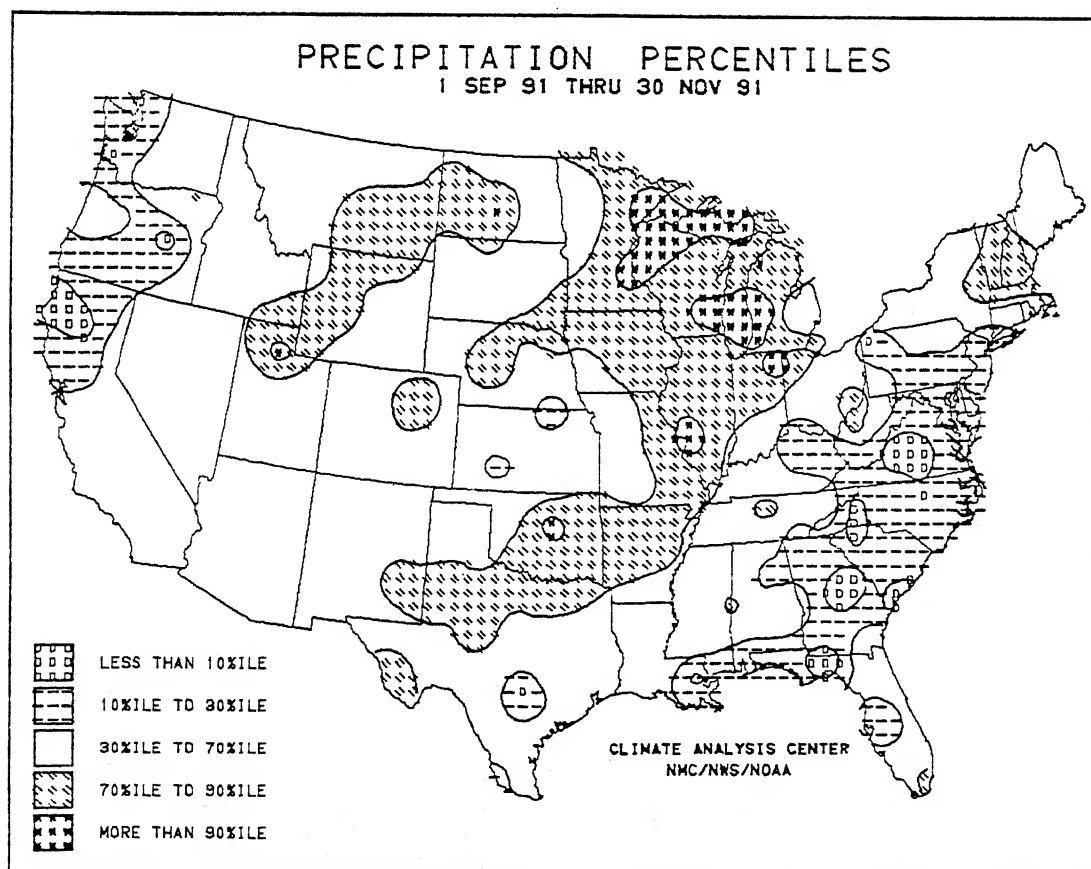


FIGURE 1. Autumn (September – November) 1991 Precipitation Percentiles. Statistically significant moisture surpluses [$> 70\%$ ile] accumulated in the central and northern Rockies, northern and southern Plains, upper and middle Mississippi Valley, Great Lakes, and Northeast. In contrast, Autumn rainfall among the drier third of climatological occurrences [$< 30\%$ ile] covered much of the middle and southern Atlantic Coast States, Pacific Northwest, and northern California.

TABLE 2. SELECTED STATIONS WITH 50% OR LESS OF THE NORMAL PRECIPITATION AND NORMAL PRECIPITATION OF 6.00 INCHES OR MORE DURING AUTUMN 1991.

STATION	TOTAL (INCHES)	PCT. OF NORMAL	NORMAL (INCHES)	STATION	TOTAL (INCHES)	PCT. OF NORMAL	NORMAL (INCHES)
MACON/WARNER AFB, GA	1.37	16.5	8.31	APALACHICOLA, FL	3.47	23.7	14.67
WAYCROSS, GA	1.43	15.5	9.21	LYNCHBURG, VA	3.48	36.6	9.51
MACON, GA	1.62	21.3	7.59	ATHENS, GA	3.92	41.1	9.54
ROANOKE, VA	2.70	29.5	9.14	GAINESVILLE, FL	3.98	37.5	10.62
TALLAHASSEE, FL	2.72	21.3	12.80	ANDERSON, SC	4.09	41.8	9.79
SAN ANTONIO, TX	2.76	31.0	8.91	SUMTER/SHAW AFB, SC	4.30	48.6	8.84
ALBANY, GA	2.93	35.6	8.22	DANVILLE, VA	4.32	48.5	8.90
GREENVILLE, SC	3.07	27.5	11.18	COLUMBIA, SC	4.45	47.8	9.31
REDDING, CA	3.20	37.0	8.64	CHARLESTON, SC	4.70	47.0	9.99
SAVANNAH, GA	3.21	34.3	9.36	ATLANTIC CITY, NJ	4.78	49.7	9.62
EUREKA, CA	3.26	34.5	9.46	ASHEVILLE, NC	4.78	47.8	10.01
VALPARAISO/EGLIN AFB, FL	3.26	25.0	13.03	PENSACOLA, FL	5.12	33.1	15.49
AUGUSTA, GA	3.36	44.4	7.57	BRUNSWICK, GA	6.06	46.1	13.15
HICKORY, NC	3.45	31.3	11.02				

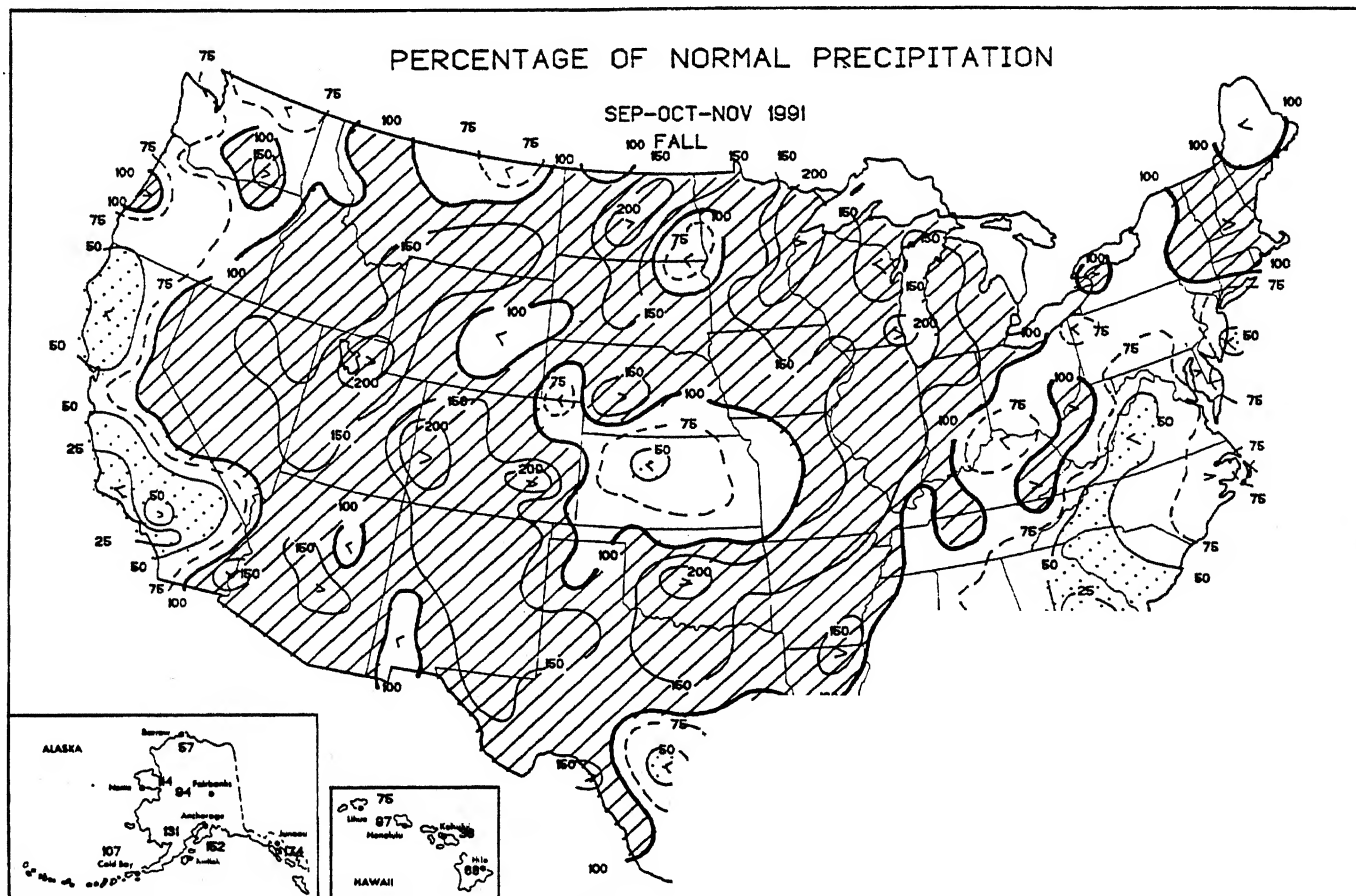


FIGURE 2. Autumn (September – November) 1991 for 0, 25, 50, 75, 100, 150, and 200. Surplus and deficit areas are shown in the Intermountain West, the Rockies, the northern and central Appalachians, and Florida. In Kansas, the central Piedmont, the Southeast, and the

TABLE 3. AUTUMN 1991 AVERAGE TEMPERATURE 3.0°F OR MORE ABOVE NORMAL.

<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
VICTORVILLE/GEORGE AFB, CA	+6.9	67.6	STOCKTON, CA	+3.9	67.2
RENO, NV	+5.2	55.3	BURBANK/HOLLYWOOD, CA	+3.8	69.7
SAN BERNARDINO/NORTON AFB, CA	+4.8	70.3	SACRAMENTO, CA	+3.7	66.5
BLUE CANYON, CA	+4.8	58.6	GLENDALE/LUKE AFB, AZ	+3.4	74.2
FRESNO, CA	+4.7	68.7	MARYSVILLE/YUBA CO, CA	+3.4	67.3
PHOENIX, AZ	+4.6	77.5	PASO ROBLES, CA	+3.4	64.8
MT SHASTA, CA	+4.4	55.4	KOTZEBUE, AK	+3.2	27.6
RED BLUFF, CA	+4.2	68.8	YUMA, AZ	+3.1	78.9
MEDFORD, OR	+4.2	58.5	DAGGETT, CA	+3.0	71.3
SEXTON SUMMIT, OR	+4.2	54.8	SAN JOSE, CA	+3.0	65.0
NOME, AK	+4.0	32.9			

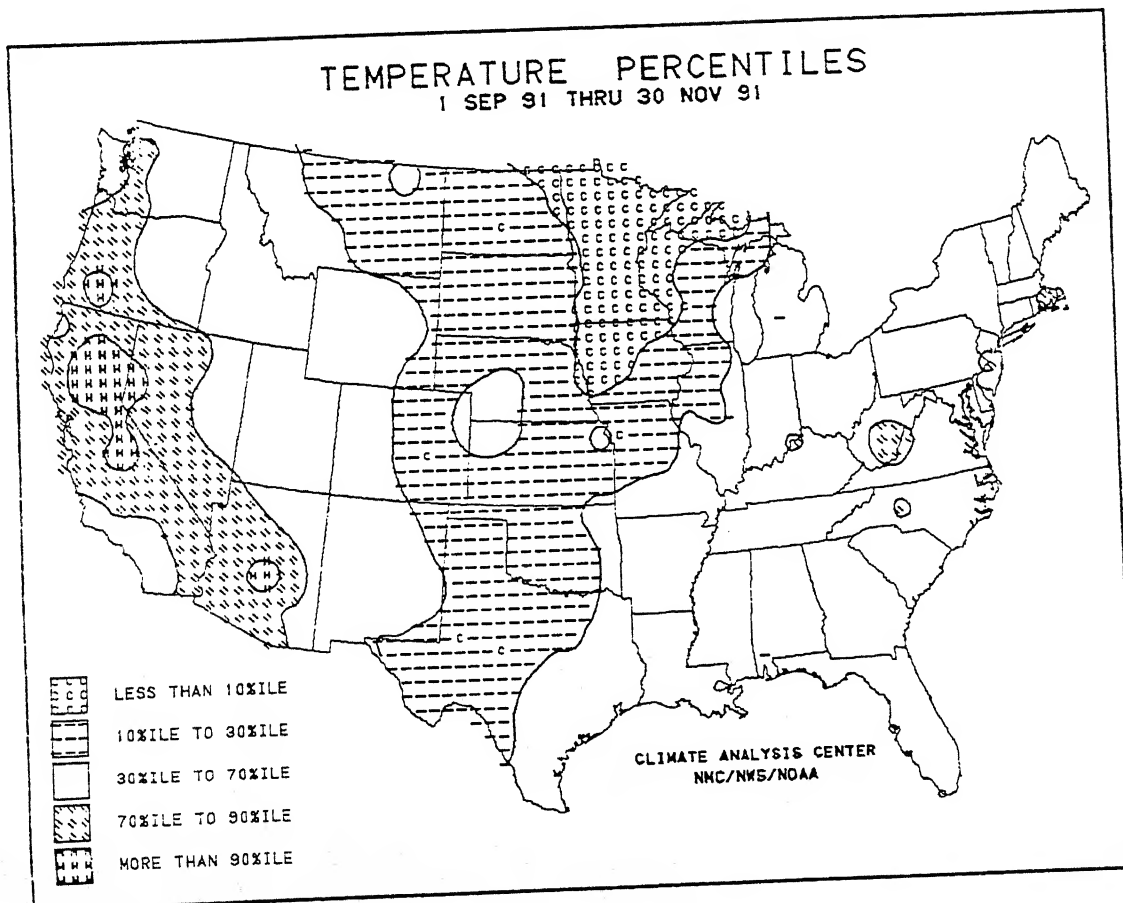


FIGURE 3. Autumn (September – November) 1991 Temperature Percentiles. *Significant autumn warmth [$>70\%$ ile] was restricted to the Far West and a portion of the central Appalachians. Unusually cool conditions [$<30\%$ ile] covered much of the Great Plains, upper and middle Mississippi Valley, and upper Great Lakes.*

TABLE 4. AUTUMN 1991 AVERAGE TEMPERATURE 3.5°F OR MORE BELOW NORMAL.

<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
WARROAD, MN	-5.7	35.7	PARK FALLS, WI	-3.8	40.0
DEVIL'S LAKE, ND	-4.6	37.8	ST CLOUD, MN	-3.8	41.1
ROCHESTER, MN	-4.6	42.4	LA CROSSE, WI	-3.8	45.6
MINNEAPOLIS, MN	-4.1	43.6	WATERTOWN, SD	-3.7	41.4
SPENCER, IA	-4.0	43.9	SIOUX CITY, IA	-3.7	47.1
MASON CITY, IA	-3.9	44.3	CEDAR RAPIDS, IA	-3.7	48.0
OMAHA/EPPLEY, NE	-3.9	49.4	INTERNATIONAL FALLS, MN	-3.6	36.7
ENID/VANCE AFB, OK	-3.9	57.9	NORTH OMAHA, NE	-3.6	49.6
FT SILL/HENRY POST AAF, OK	-3.9	59.8	EAU CLAIRE, WI	-3.5	42.6
DULUTH, MN	-3.8	38.5	KANSAS CITY/INTL, MO	-3.5	54.4

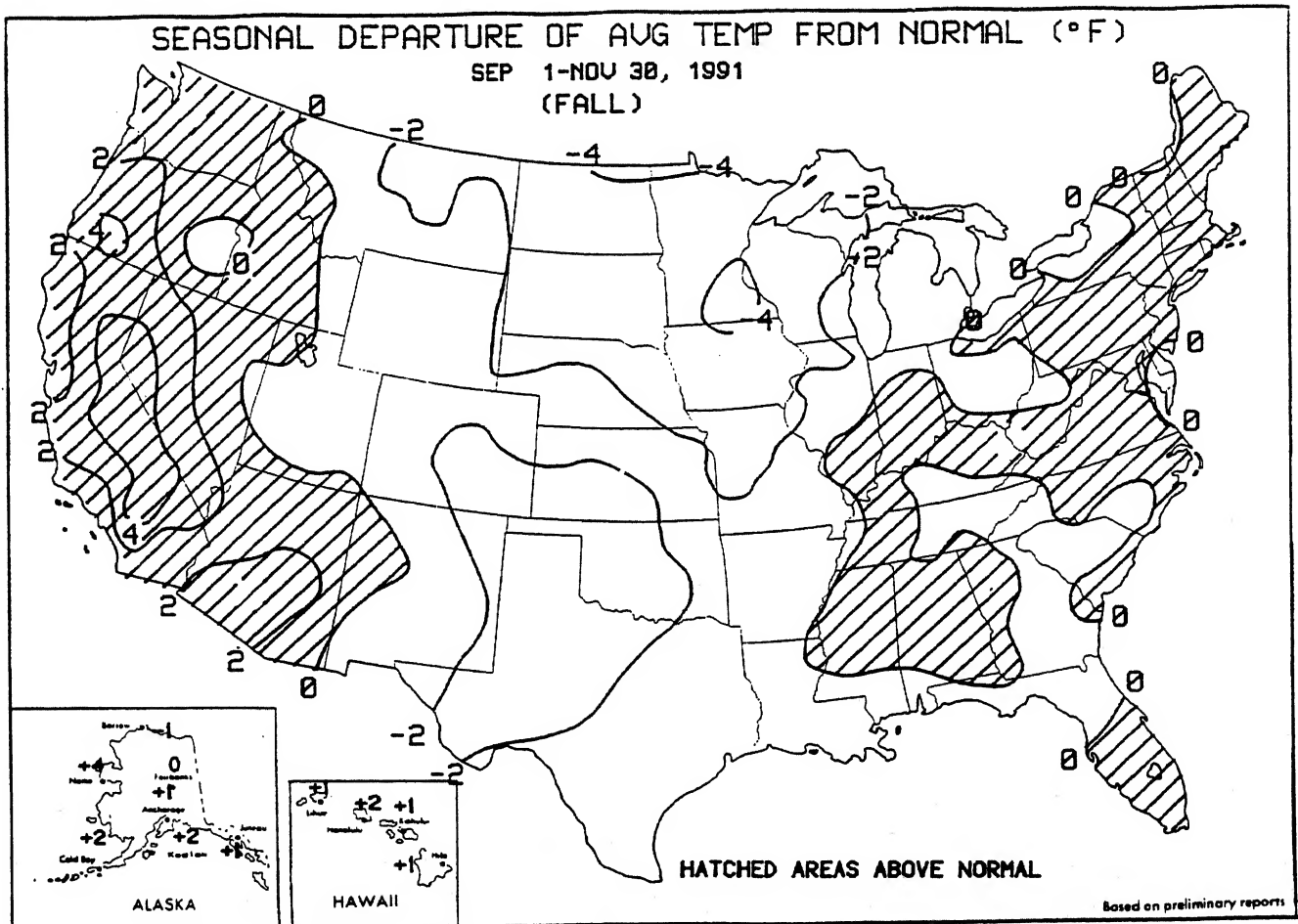


FIGURE 4. Autumn (September – November) 1991 Departure of Average Temperature from Normal (°F). Isopleths drawn only for -4°F, -2°F, 0°F, +2°F, and +4°F. Much of the western and eastern thirds of the nation experienced warmer than normal conditions. Seasonal departures reached +2°F to +5°F in interior California and western Nevada. Cooler than normal conditions, however, generally prevailed across much of the Plains and upper Midwest, where temperatures averaged 2°F to 4°F below normal.

TEMPERATURE RANKINGS FOR SEP - NOV 1991, BASED ON THE PERIOD 1895 TO 1991. 1 = COLDEST AND 97 = WARMEST.

<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>
AL	28	IA	5	NE	12	RI	86
AZ	95	KS	16	NV	92	SC	31
AR	17	KY	64	NH	68	SD	13
CA	96	LA	23	NJ	61	TN	34
CO	26	ME	54	NM	11	TX	8
CT	74	MD	50	NY	48	UT	50
DE	40	MA	38	NC	51	VT	72
FL	39	MI	21	ND	14	VA	65
GA	28	<i>MN</i>	8	OH	46	WA	61
ID	39	MS	41	OK	20	WV	60
IL	19	MO	17	OR	82	<i>WI</i>	<i>10</i>
IN	47	MT	27	PA	58	WY	33

National Climatic Data Center

Top 10 rankings : **BOLD**

Bottom 10 rankings : *Italics*

PRECIPITATION RANKINGS FOR SEP - NOV 1991, BASED ON THE PERIOD 1895 TO 1991. 1 = DRIEST, 97 = WETTEST.

<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>
AL	47	IA	80	NE	69	RI	82
AZ	43	KS	25	NV	65	<i>SC</i>	6
AR	72	KY	38	NH	68	SD	51
CA	8	LA	57	NJ	22	TN	48
CO	84	ME	60	NM	80	TX	64
CT	65	MD	25	NY	58	UT	89
DE	21	MA	87	NC	14	VT	73
<i>FL</i>	8	MI	83	ND	72	VA	17
<i>GA</i>	6	MN	91	OH	19	WA	28
ID	48	MS	53	OK	79	WV	30
IL	93	MO	73	OR	13	WI	84
IN	75	MT	56	PA	24	WY	53

National Climatic Data Center

Top 10 rankings : **BOLD**

Bottom 10 rankings : *Italics*

EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC ADVISORY 91/08

issued by

**DIAGNOSTICS BRANCH
CLIMATE ANALYSIS CENTER, NMC**

DECEMBER 10, 1991

Warm (ENSO) episode conditions continued to evolve throughout the equatorial Pacific in November. Low-level westerly anomalies prevailed throughout the equatorial Pacific, as sea surface temperature (SST) anomalies increased in the Niño 3 region and in many other areas of the tropical eastern and central Pacific (Fig. 1b). Increases in SST anomalies along the South American coast in late October were sustained throughout November, with some coastal stations reporting positive anomalies of 2 to 3°C. Enhanced convection (negative outgoing longwave radiation (OLR) anomalies), which developed over the central equatorial Pacific during late October persisted and intensified during November (Fig. 2). At the same time, positive OLR anomalies persisted over sections of Indonesia and the Philippines. This pattern of OLR anomalies is a feature generally observed during the mature phase of warm (ENSO) episodes.

The rapid evolution toward mature warm episode conditions that has been observed since September is similar to that which occurred in 1986, as the 1986 – 1987 ENSO episode developed. During November 1986, enhanced convection developed in the central equatorial Pacific, accompanied by the development of anomalous subtropical and extratropical upper tropospheric circulation features generally found during warm (ENSO) episodes. Some of those features, such as the upper tropospheric anticyclonic anomaly couplet straddling the equator near the date line, are weakly indicated in the analysis for November 1991.

During November 1991 there was a tendency for the enhanced equatorial convection and low-level westerly anomalies to shift eastward relative to their November 1986 counterparts. It is still too early to tell if this eastward shift will be a persistent feature of this warm episode. However, data from early December indicate a continuation of this trend, with the development of a tropical storm in the vicinity of American Samoa (15°S, 170°W) and strong low-level westerly anomalies extending as far east as 160°W near 5°S.

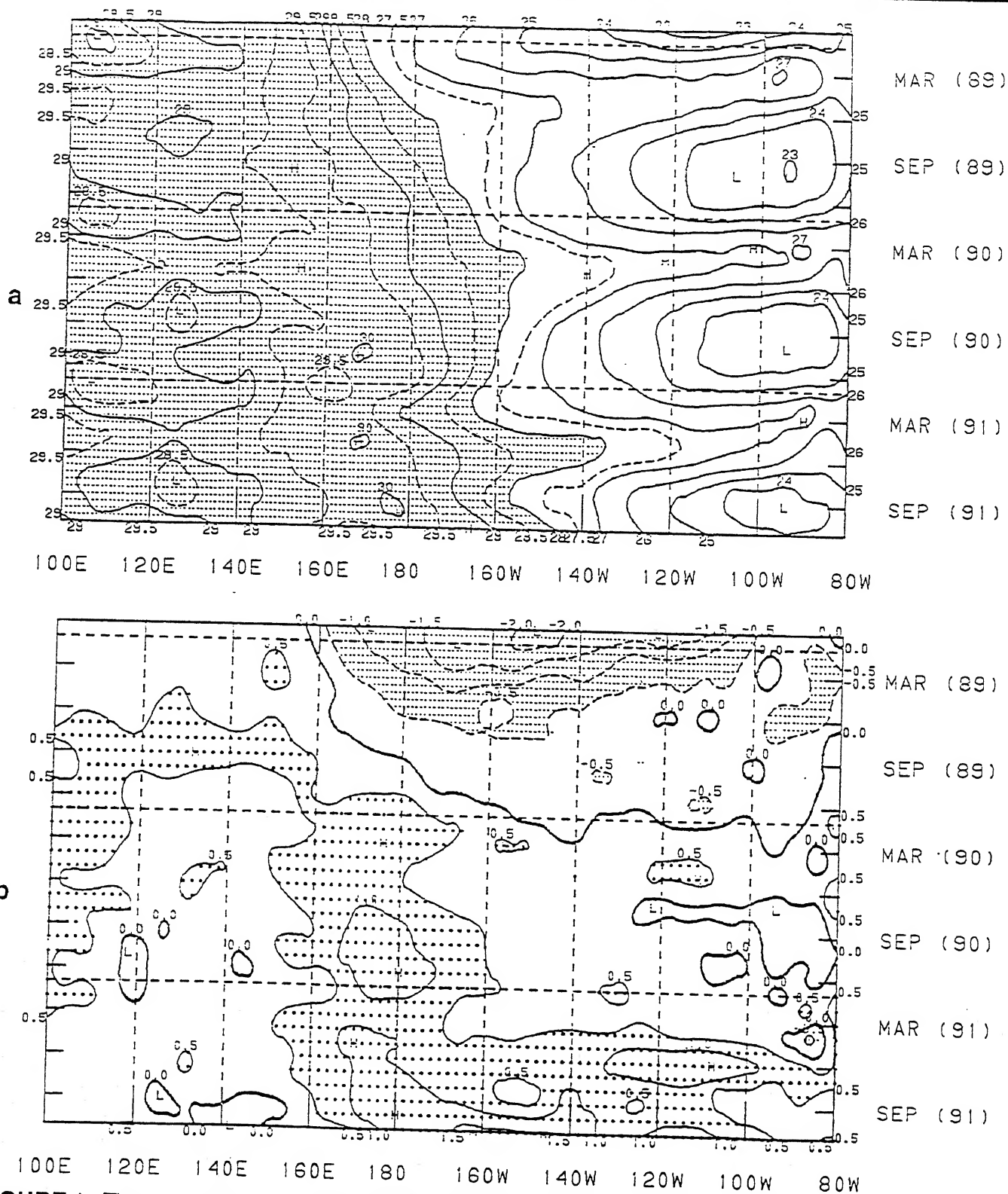
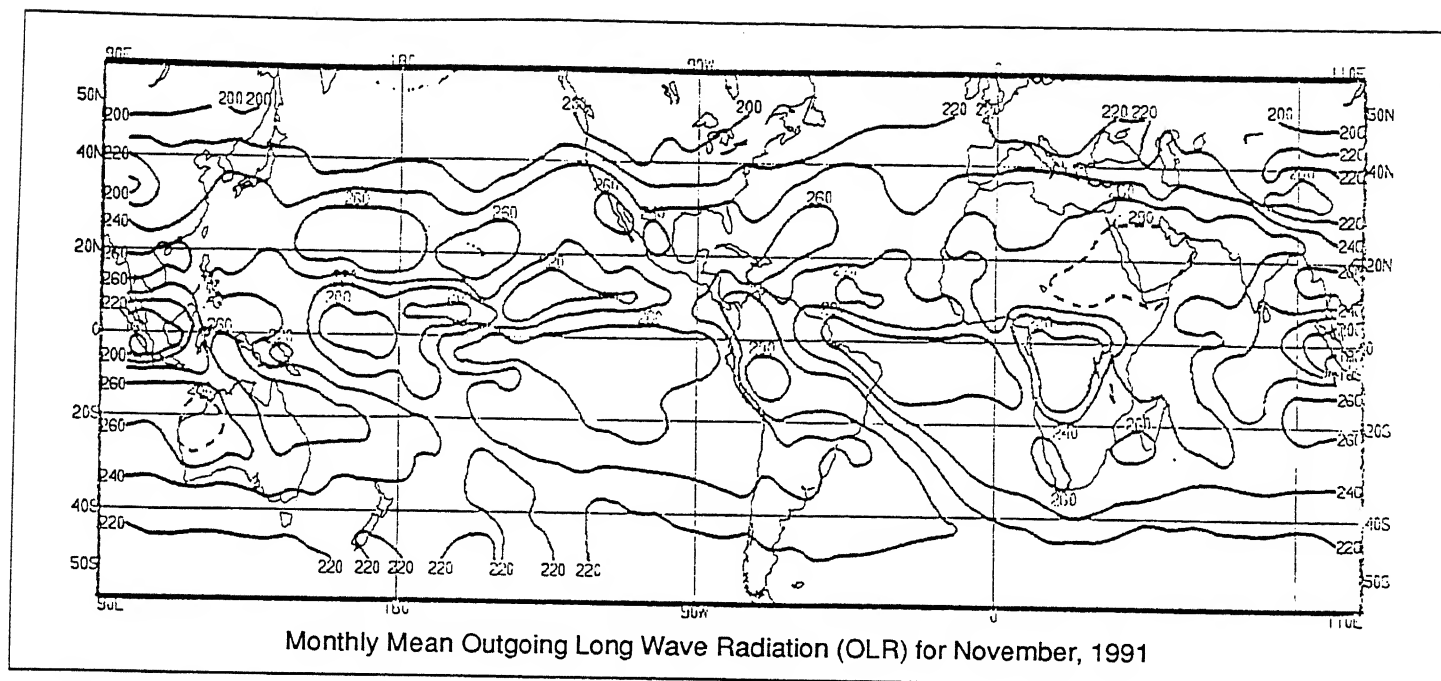


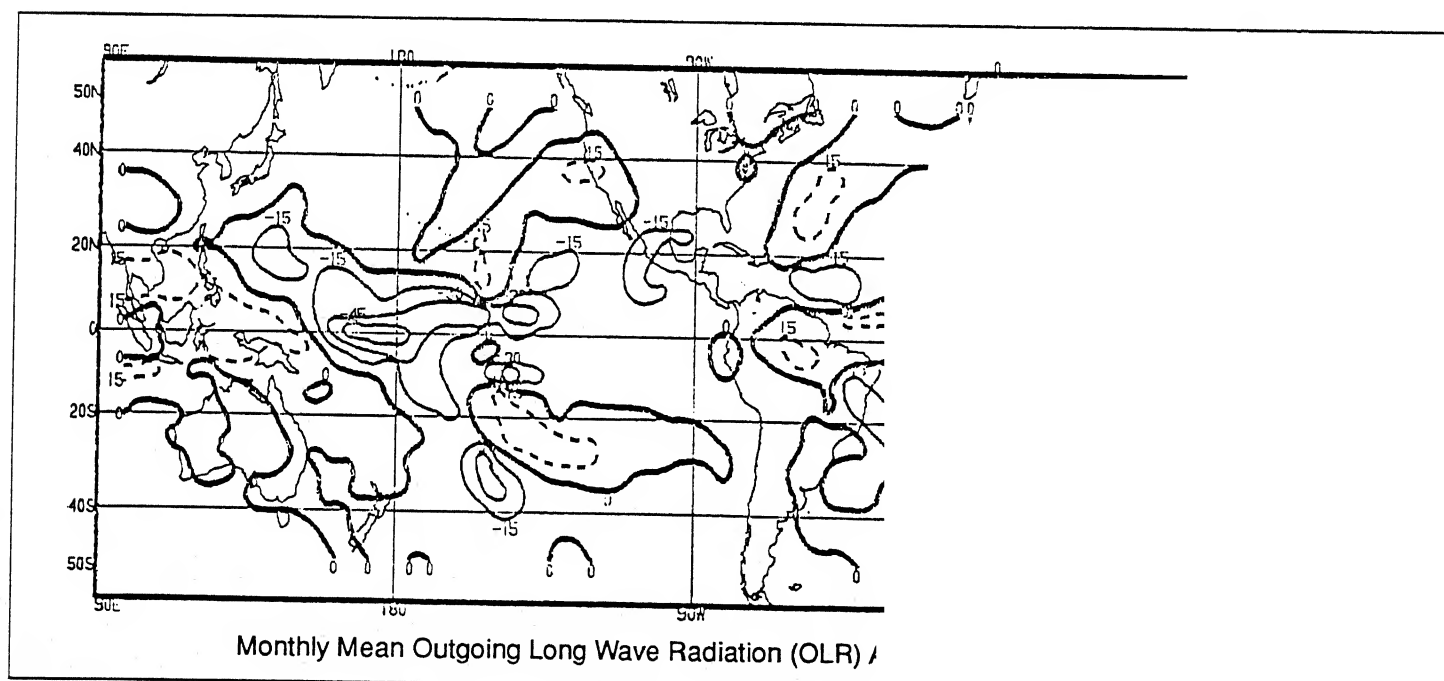
FIGURE 1. Time-Longitude Section of Monthly Sea Surface Temperature, a) Mean and b) Anomalous, for 5°N–5°S. Contour interval is 1°C and 0.5°C, respectively. SST values greater than 28°C and anomalies less than -0.5°C are shaded. Stippled areas indicate anomaly values greater than 0.5°C. Anomalies are computed based on the COADS/ICE climatology (Reynolds, 1988, *J. Climate*, 1, 75-76).



EXPLANATION

FIGURE 2a. The mean monthly outgoing long wave radiation (OLR) as measured by the NOAA-9 AVHRR IR window channel by NESDIS/SRL (top). Data are accumulated and averaged over 2.5° areas to a 5° Mercator grid for display. Contour intervals are 20 Wm^{-2} , and contours of 280 Wm^{-2} and above are dashed. In tropical areas (for our purposes $20^\circ\text{N} - 20^\circ\text{S}$) that receive primarily convective rainfall, a mean OLR value of less than 200 Wm^{-2} is associated with significant monthly precipitation, whereas a value greater than 260 Wm^{-2} normally indicates little or no precipitation. Care must be used in interpreting this chart at higher latitudes, where much of the precipitation is non-convective, or in some tropical coastal or island locations, where precipitation is primarily orographically induced. The approximate relationship between mean OLR and precipitation amount does not necessarily hold in such locations.

FIGURE 2b. The mean monthly outgoing long wave radiation anomalies (bottom) are computed as departures from the 1979 - 1988 base period mean. Contour intervals are 15 Wm^{-2} , while positive anomalies (greater than normal OLR, suggesting less than normal cloud cover and/or precipitation) are dashed and negative anomalies (less than normal OLR, suggesting greater than normal cloud cover and/or precipitation) are solid.



ATMOSPHERIC AND SEA SURFACE TEMPERATURE (SST) INDICES

DATE	SLP ANOMALIES		TAHITI-DARWIN SOI	PACIFIC 850 MB ZONAL WIND INDICES			PACIFIC 200 MB ZONAL WIND INDEX	OLR INDEX	PACIFIC SST					
	TAHITI	DARWIN		5N-5S 135E-180	5N-5S 175W-140W	5N-5S 135W-120W			NINO 1+2 0-10S 90W-80W		NINO 3 5N-5S 150W-90W		NINO 4 5N-5S 160E-150W	
NOV 91	0.0	1.4	-0.8	-1.7	-1.4	-1.2	-0.2	-2.4	0.4	21.9	1.1	26.0	1.1	29.4
OCT 91	-1.8*	0.4	-1.4*	-0.1	-0.8	-1.2	-0.6	-0.3	0.4	21.1	0.8	25.7**	1.2	29.6
SEP 91	-1.4	1.4	-1.8	-1.1	-1.1	-1.3	-0.4	-0.6	0.3	20.9	0.6	25.4	0.8	29.1
AUG 91	0.0	1.4	-0.9	-0.3	-0.2	0.2	0.7	-1.0	0.3	21.3	0.5	25.5	0.9	29.2
JUL 91	0.3	0.6	-0.2	-0.2	-0.5	-0.6	0.1	-0.2	0.9	22.6	1.0	26.6	0.9	29.4
JUN 91	0.1	1.0	-0.5	-0.3	-0.8	-1.1	-0.6	-0.1	0.4	23.2	1.3	27.6	0.8	29.3
MAY 91	-0.6	1.7	-1.5	-0.5	-0.7	-0.9	-1.2	-0.2	0.5	24.6	1.0	27.8	0.9	29.4
APR 91	-1.1	0.5	-1.0	-0.2	0.3	0.2	-0.6	-0.2	-0.3	25.2	0.4	27.6	0.8	29.1
MAR 91	-0.1	2.1	-1.4	-0.9	0.1	-0.1	0.2	-0.2	0.5	26.7	0.3	27.2	0.5	28.6
FEB 91	0.0	0.1	-0.1	0.4	0.3	0.9	-0.1	-0.6	0.5	26.2	0.2	26.5	0.7	28.7
JAN 91	1.0	0.1	0.6	0.5	0.3	0.1	0.1	-0.3	0.0	24.3	0.4	25.8	0.8	28.9
DEC 90	-0.3	0.4	-0.5	-0.6	-0.6	-0.6	-0.8	-0.3	0.0	22.5	0.2	25.3	1.0	29.2

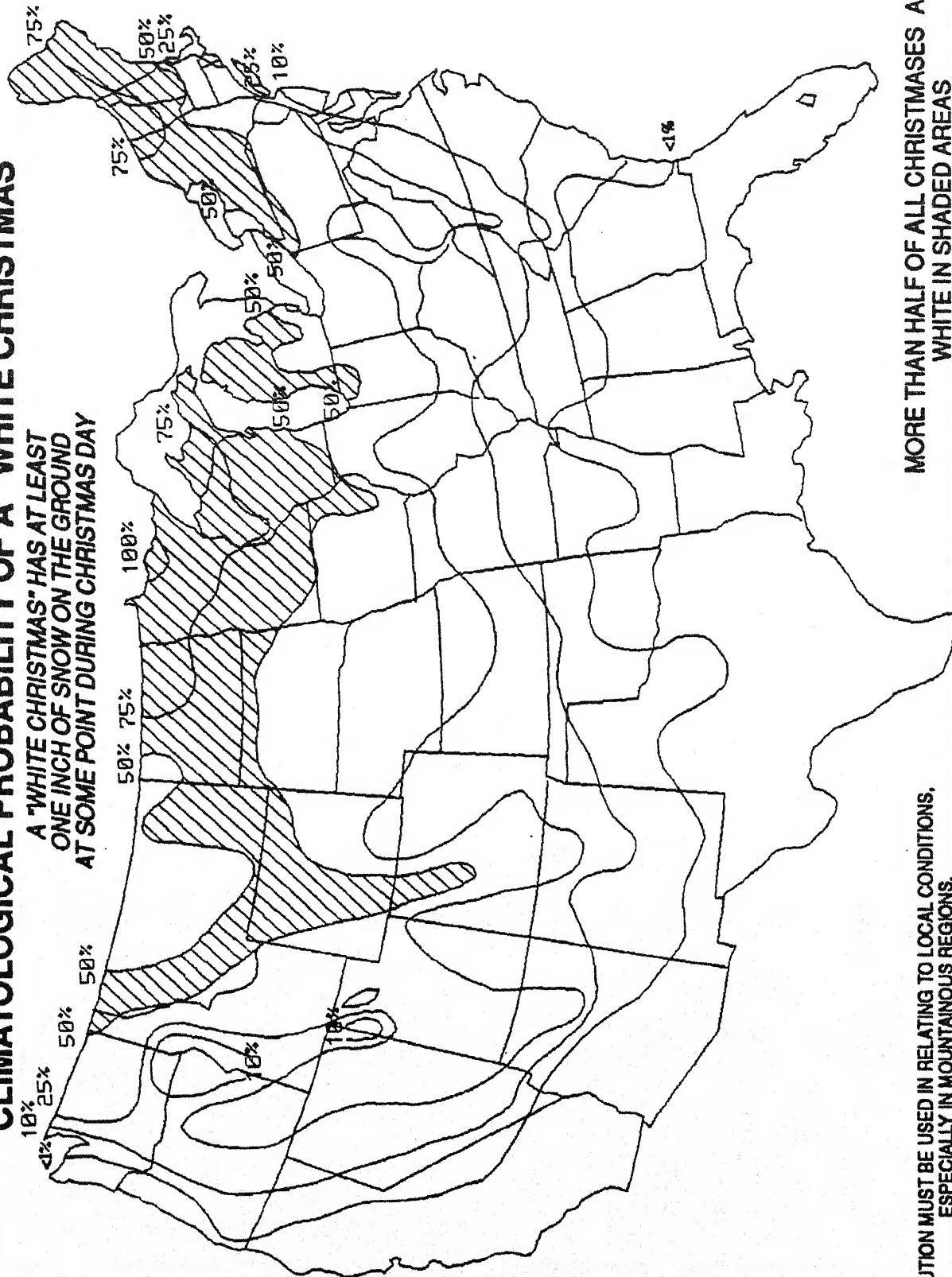
* PRELIMINARY

** REVISED

Atmospheric and SST index values for the most recent 12 months. Atmospheric indices are standardized by the mean annual standard deviation except for the Tahiti and Darwin SLP anomalies which are in mb. SST indices (anomalies and means) are in degrees Celsius. Note that positive (negative) values of the 200 mb Zonal Wind Index imply westerly (easterly) anomalies; positive (negative) values of the 850 mb Zonal Wind Indices imply easterly (westerly) anomalies.

CLIMATOLOGICAL PROBABILITY OF A "WHITE CHRISTMAS"

A "WHITE CHRISTMAS" HAS AT LEAST
ONE INCH OF SNOW ON THE GROUND
AT SOME POINT DURING CHRISTMAS DAY



MORE THAN HALF OF ALL CHRISTMASES ARE
WHITE IN SHADED AREAS

CAUTION MUST BE USED IN RELATING TO LOCAL CONDITIONS,
ESPECIALLY IN MOUNTAINOUS REGIONS.